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OL. XI. PUBLICATION OFFICE, TORONTO, JANUARY, 1921 No. 1

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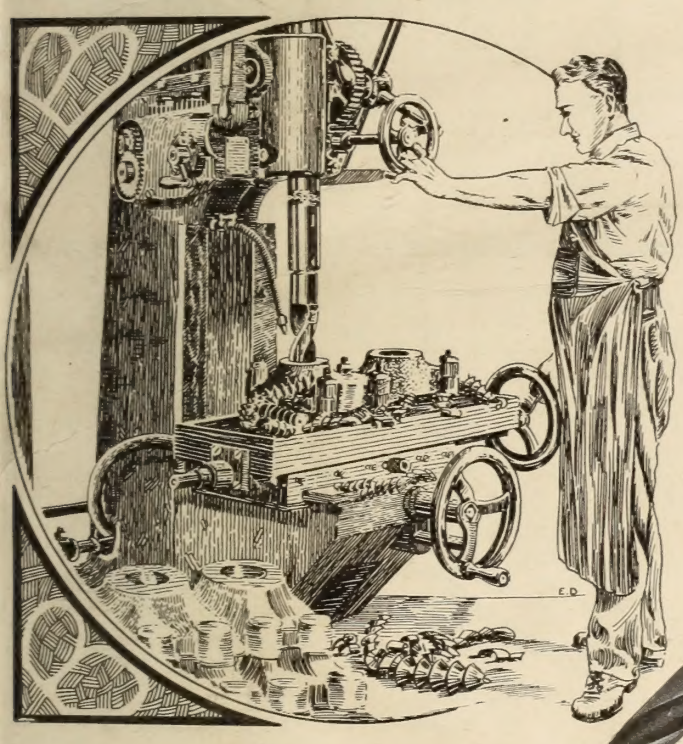

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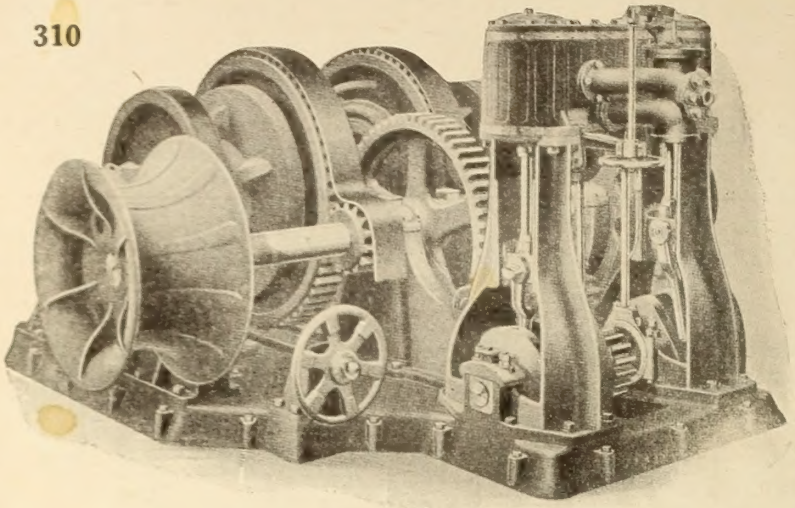

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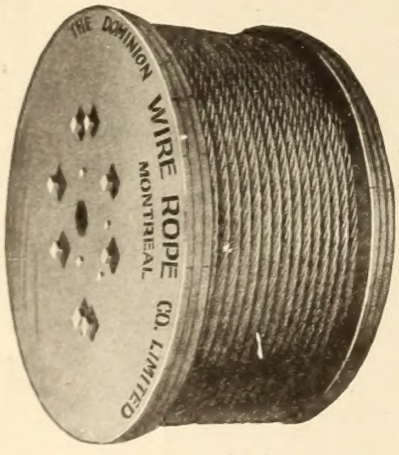

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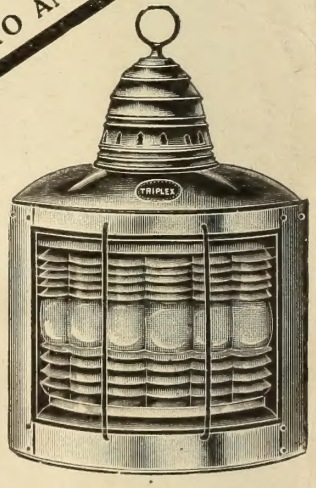

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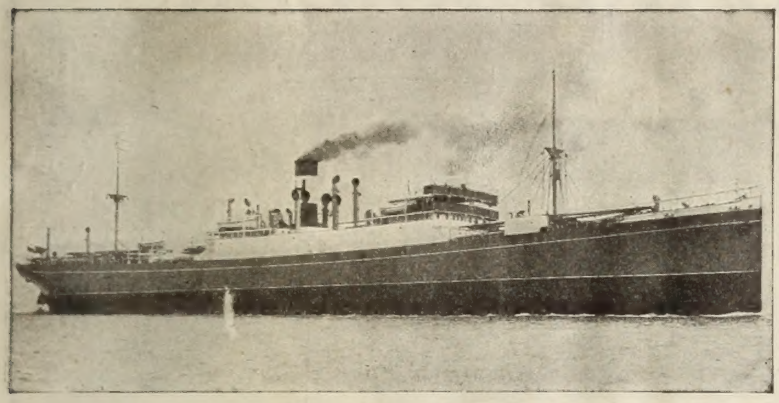

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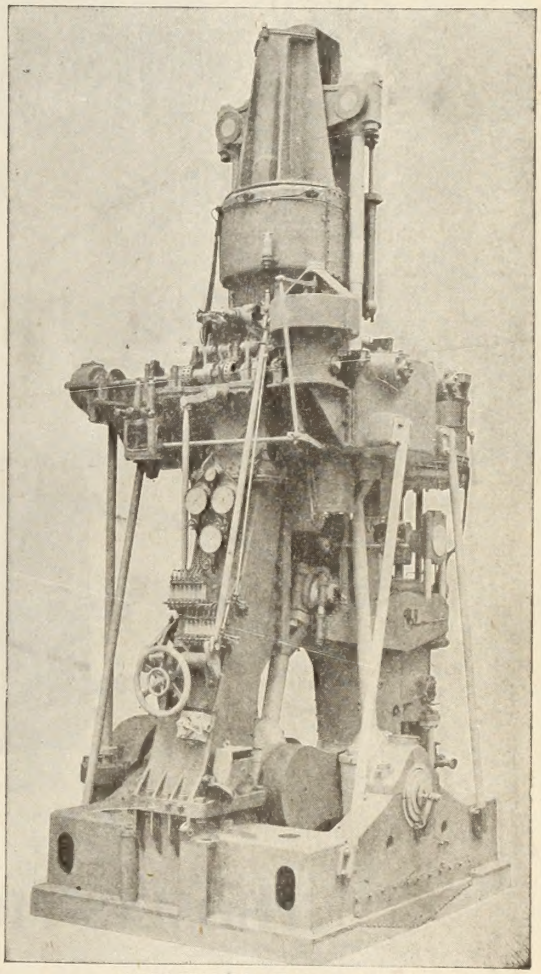

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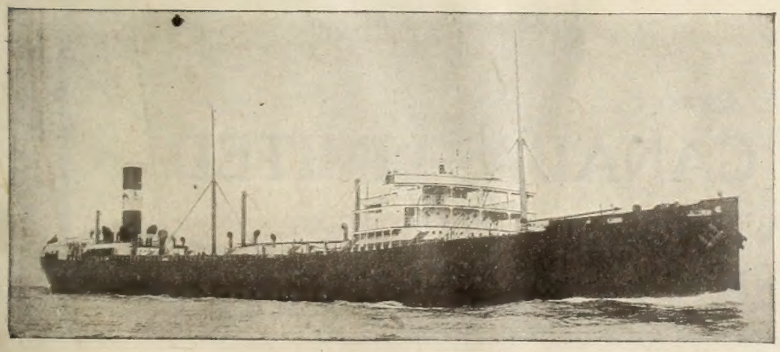

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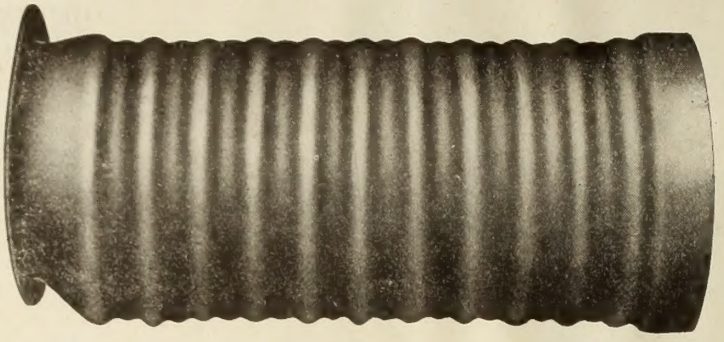

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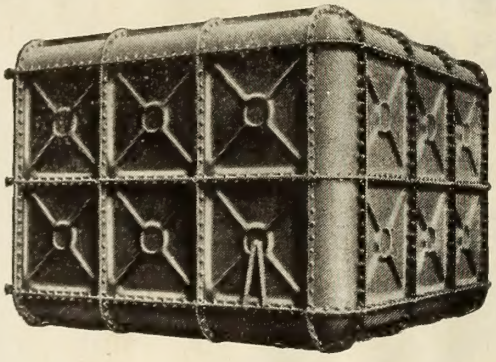

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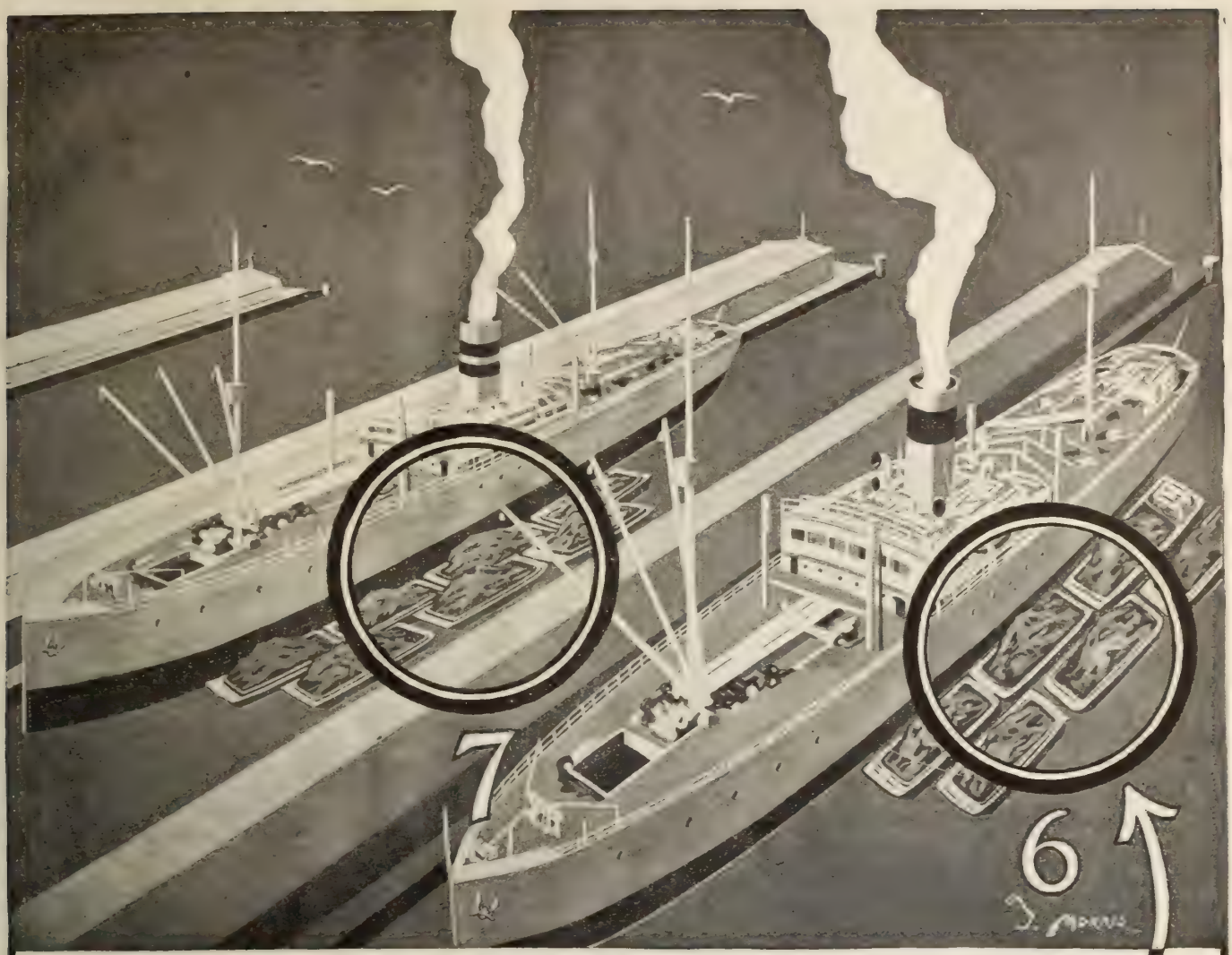

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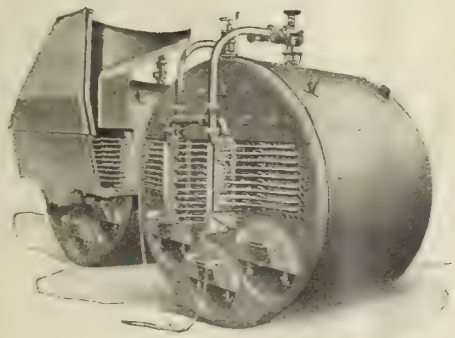

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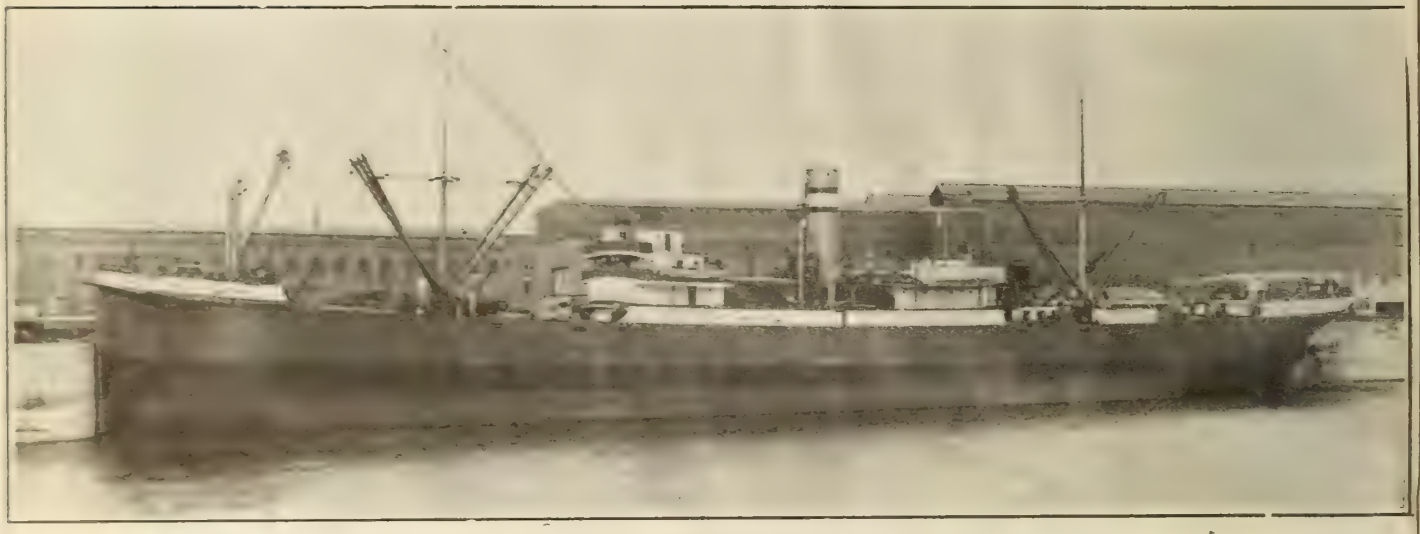

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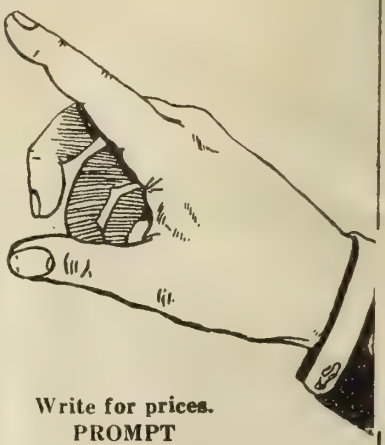

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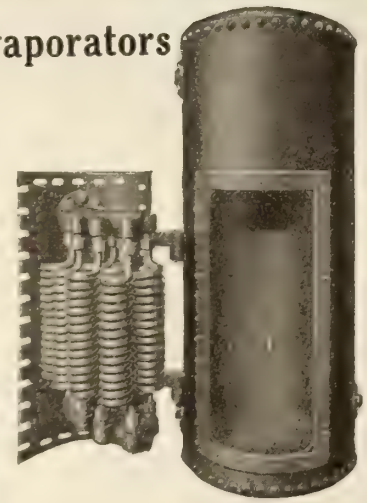

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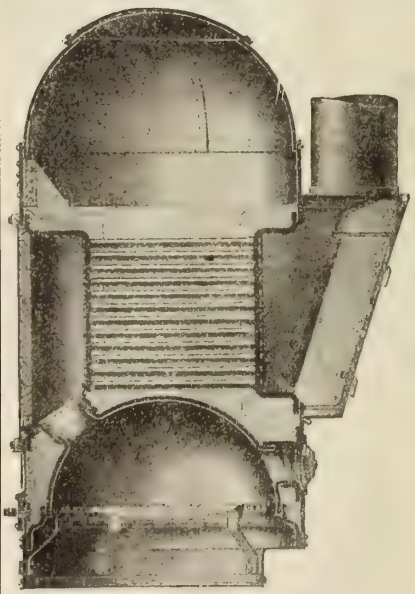

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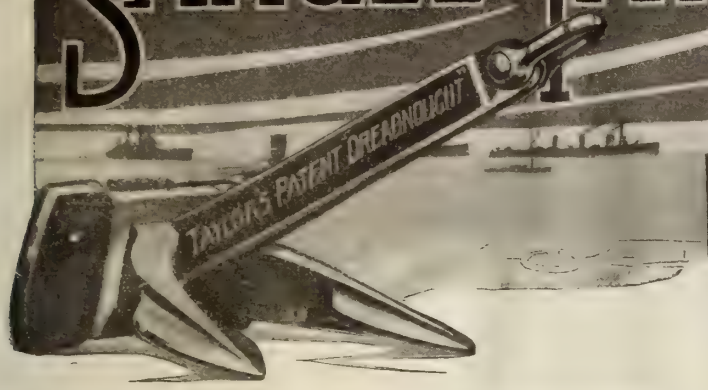

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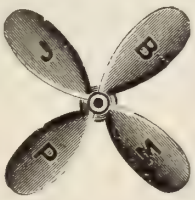

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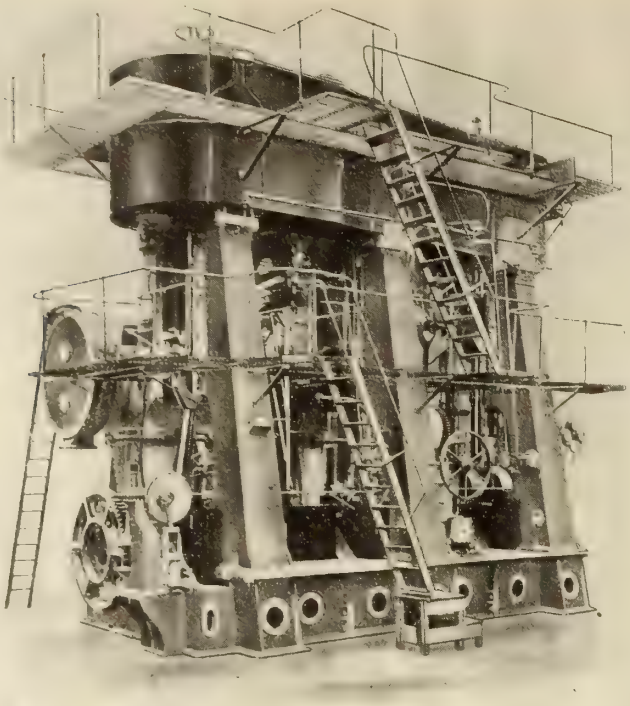

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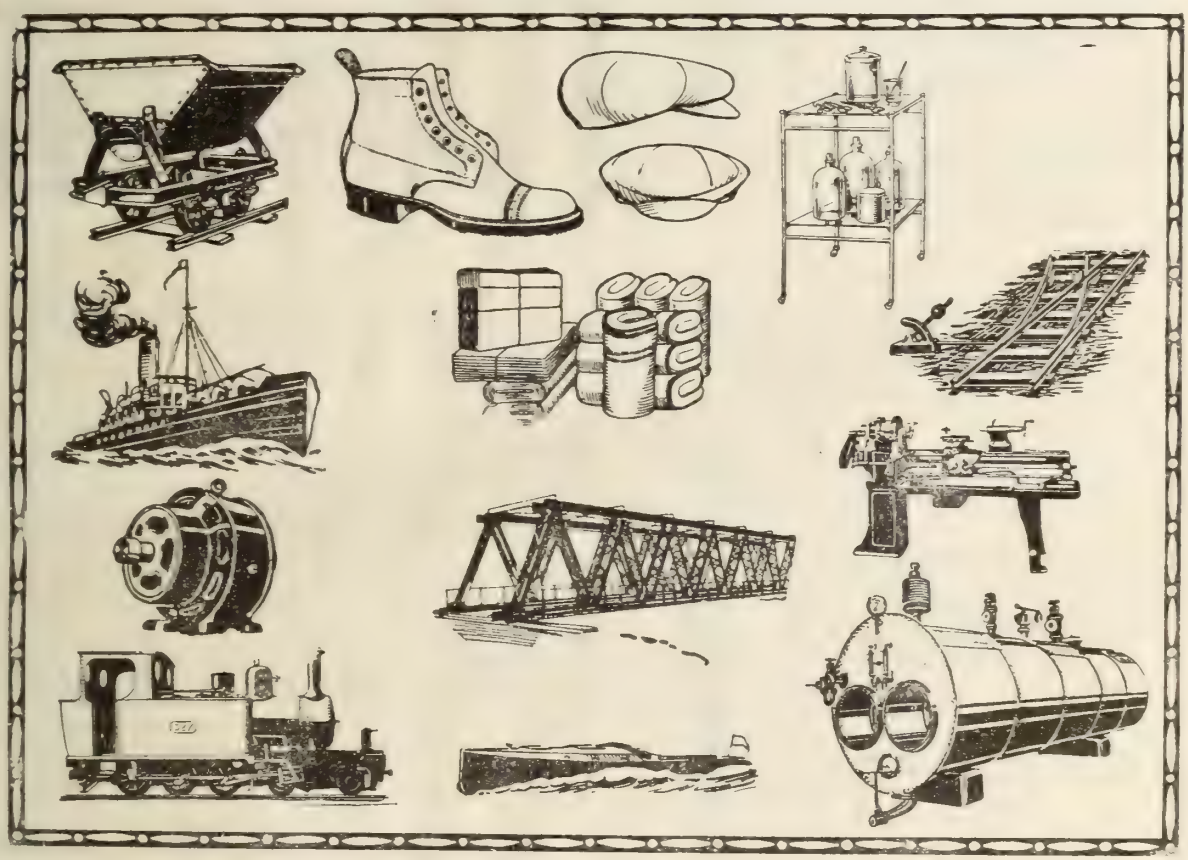

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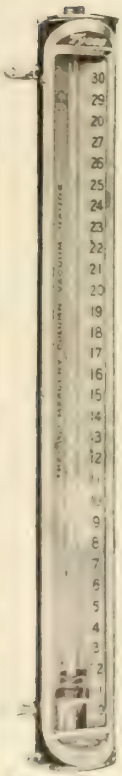

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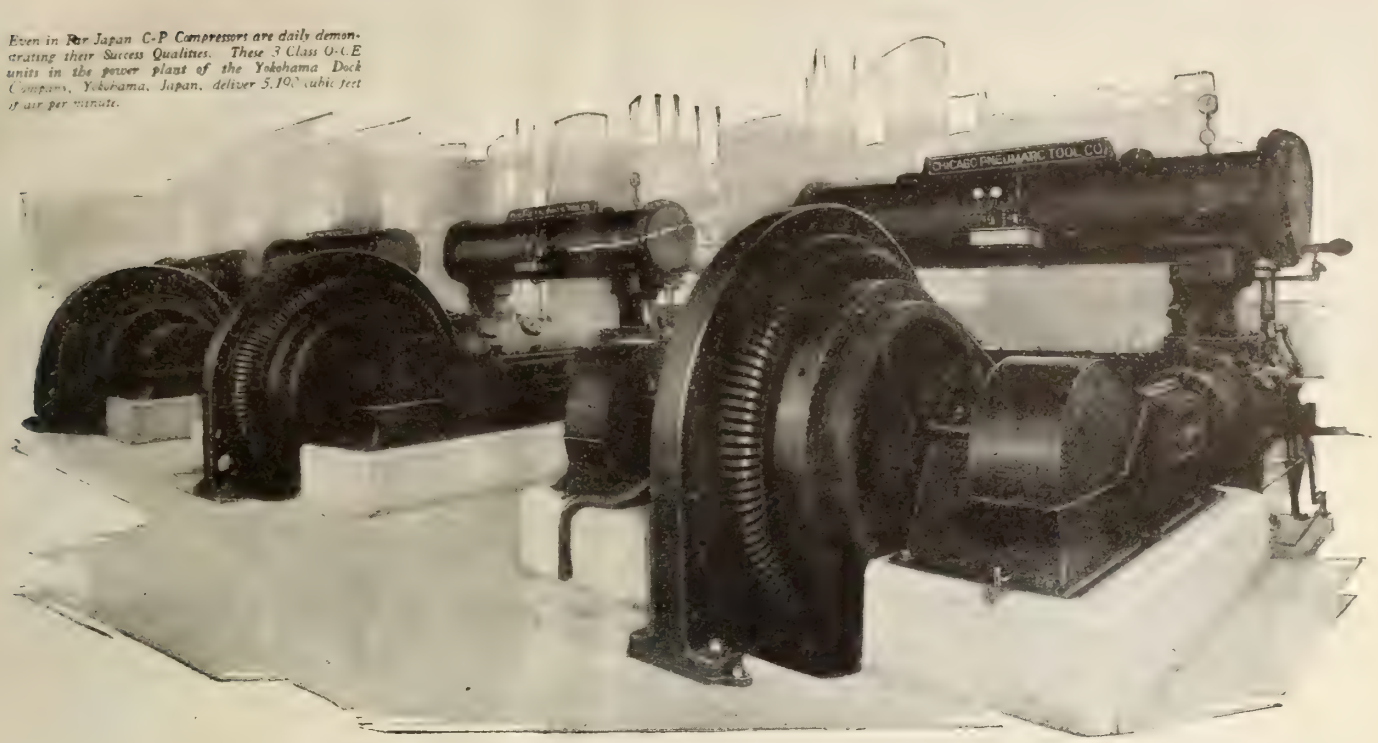

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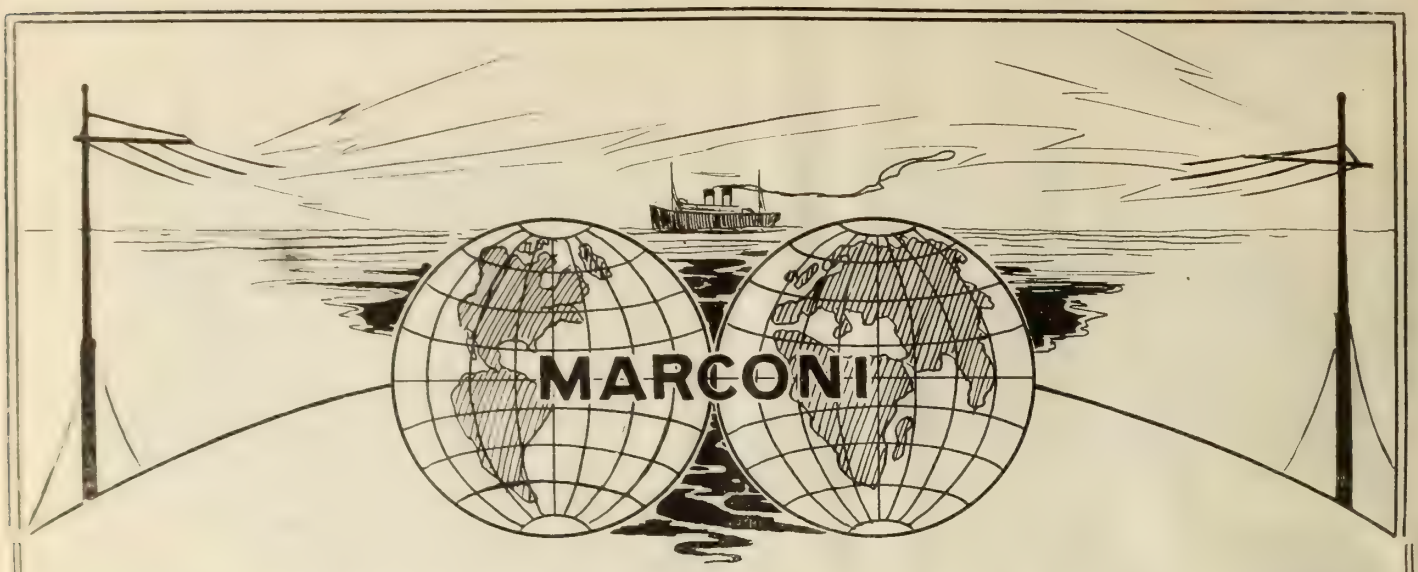

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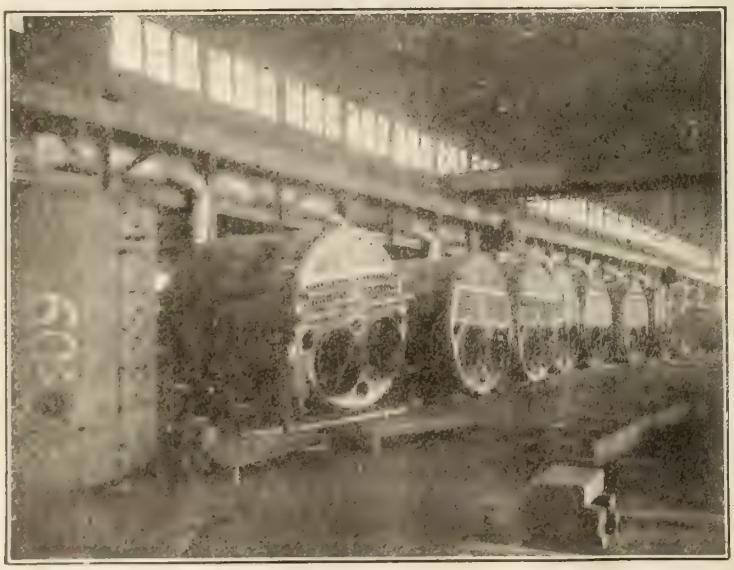

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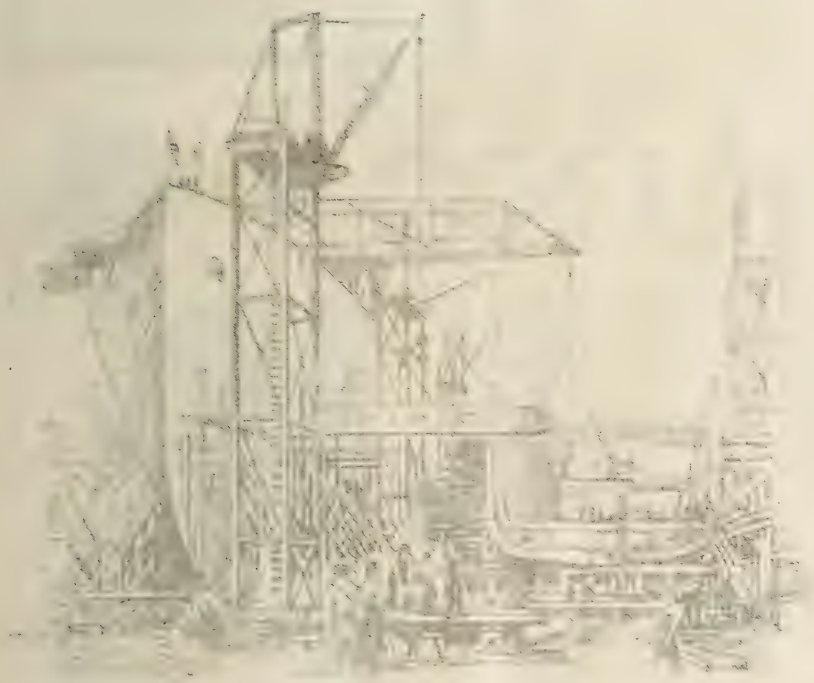

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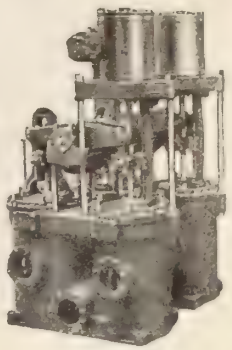

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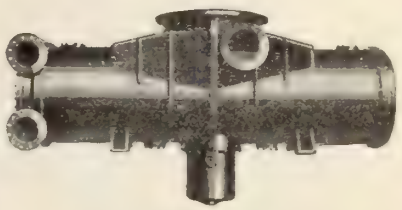

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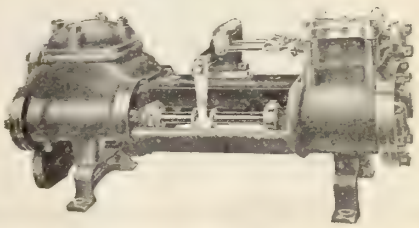

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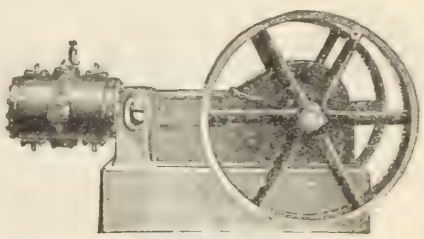

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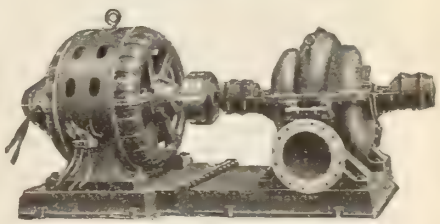

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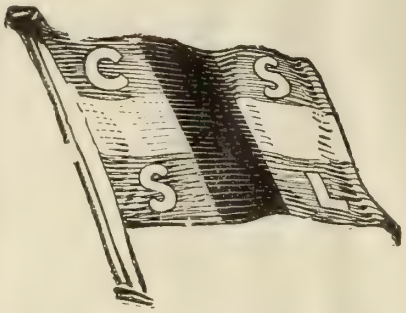

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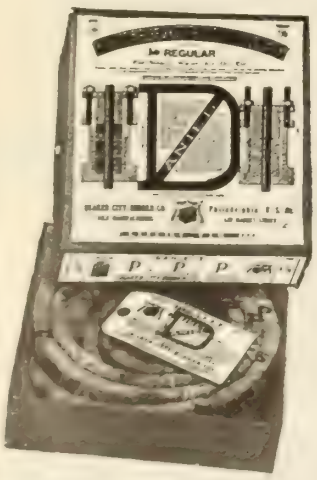

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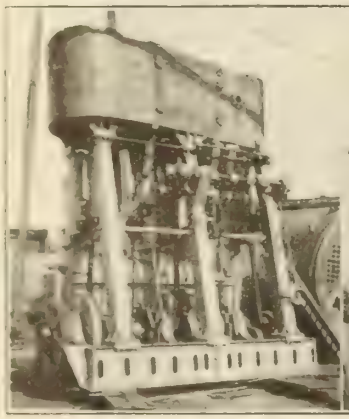

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Vol. XI. JANUARY, 1921 No. 1

The Evolution of a New Type of Propeller*

As a Result of Careful Investigations and Experiments, a Propeller Fitted With an Outside Rim or Shroud Has Been Evolved And is Here Described.

By MAJOR H. W. GILL, O.B.E.

DURING the past three-quarters of a century the screw propeller has received the attention of many eminent mathematicians and experimentalists. Its action has been explained by several different theories, some of which are duly supported by mathematical proofs, and the results of much laborious and carefully conducted experimental work are recorded in various publications.

In spite, however, of the amount of attention devoted to this subject the need for fuller investigation is admitted by the best authorities, even when the screw propeller is considered apart from the effects of, and on, the hull of the vessel to which it is attached.

When dealing with a complex subject it is advisable to confine the investigation, in the first place, to considerations affecting the prime essential, which in this case is the screw propeller itself, apart from hull effects, and to arrive at a clear conception of the first principles involved, in so far as these can be ascertained.

Probably the clearest fundamental definition of a screw propeller is that given by Mr. G. S. Baker, who states that:

"A screw propeller is a means of pushing a ship forward by thrusting water aft";

while Mr. S. W. Barnaby has condensed the elementary theory of propeller action in the following words:

"If the weight of the mass of water acted upon by the propeller in pounds per second = W, and if the sternward velocity in feet per second imparted to it in relation to still water = S, then the reaction which constitutes the propelling force is $\frac{W.S.}{g}$, where "g"=32.2 feet per second."

This fundamental conception of the general principle of the operation of a screw propeller constitutes a starting point from which the study of propeller action may be undertaken; and the further this study is pursued, the more apparent becomes its complexity.

If a screw propeller merely acted upon a column of water of approximately its own diameter and pushed this column directly aft, then its action would be fully explained on simple theoretical grounds.

In practice, however, a propeller acts upon a column of water which has a diameter greater than its own, on the intake side, and contracts to considerably less than its own diameter, on the discharge side; this contraction of the whole column of water directly acted upon depending on the accleration imparted to the water by the screw, and only a small portion of the total acceleration and consequent contraction taking place while the water is actually passing through the screw. Furthermore, the column of water acted upon is given a spiral motion by reason of the rotation of the propeller, is disturbed by centrifugal action while in contact with the blades of the propeller, and is incomplete as a column on the discharge side, owing to blade interference and other causes tending to unequal accleration and pressure values over different portions of the section of the column.

These variants of the simple fundamental conception of propeller action all come into operation even when the propeller is working under conditions as nearly ideal as can be practically attained, while further complications are introduced by the effects of blade thickness, form, and pitch. If air is taken down from the surface, or released from the water, still further disturbance of theoretical conditions occurs, apart from the true cavitational effect which obtains when the total head of the water acted on by an immersed propeller is insufficient to balance the velocity of flow necessary to follow up the blades of the screw.

In view of the numerous departures from ideal conditions of operation, which are inseparable from the working of propellers in actual practice, it is evident that the assumptions which are necessary as a basis for any serviceable theoretical treatment of the subject must be modified in accordance with the results obtained from consistent and carefully conducted trials, carried out with models of a reasonable scale under conditions resembling those of actual practice.

A long series of such trials was carried out by the Messrs. Froude in Great Britain and by Admiral Taylor in the United States, and the results of these trials, supplemented by the less exhaustive work of other investigators, and by observations of full scale trials, have at least served to establish the principle of similitude as applicable to screw propellers and to lay down certain broad rules for propeller design which have been summarized by Mr. Peter Doig, as follows:

"The best diameter to use (for a screw propeller) is closely proportional to the fifth root of the horse-power, inversely proportional to about the six-tenths power of the revolutions per minute; and practically independent of the speed of the boat." Also "The pitch ratio, or Pitch divided by Diameter, varies inversely with the value: Diameter multiplied by Revolutions and divided by Speed."

It is also generally accepted as the result of experiment that "gaining pitch," though theoretically desirable, has proved to be of little if any value with the open type of screw propeller; that small bosses, thin blades, and high finish make for efficiency; that in many cases it is of practical advantage to work at a relatively high slip, and that notwithstanding the labors of many eminent men, much remains to be established on the subject of screw propeller design, especially in the case of high revolution speeds.

Now there is a quantity of published information extant which, if carefully analyzed, appears to point towards one solution of the problem of high-speed screw propellers and to indicate that the most satisfactory method of approaching the investigation is by consideration of, and experiment on, the actual conditions of flow through and around typical screw propellers revolving in a water channel of relatively large sectional area.

The Theorem of Bernonilli relating to fluid flow defines the conditions as to pressures and velocities in an accelerated stream, under ideal circumstances.

The writings of Mr. R. E. Froude deal minutely with the theoretical aspect of the acceleration and contraction of the stream of fluid acted upon by the pro

*Transactions of the Institute of Marine Engineers.

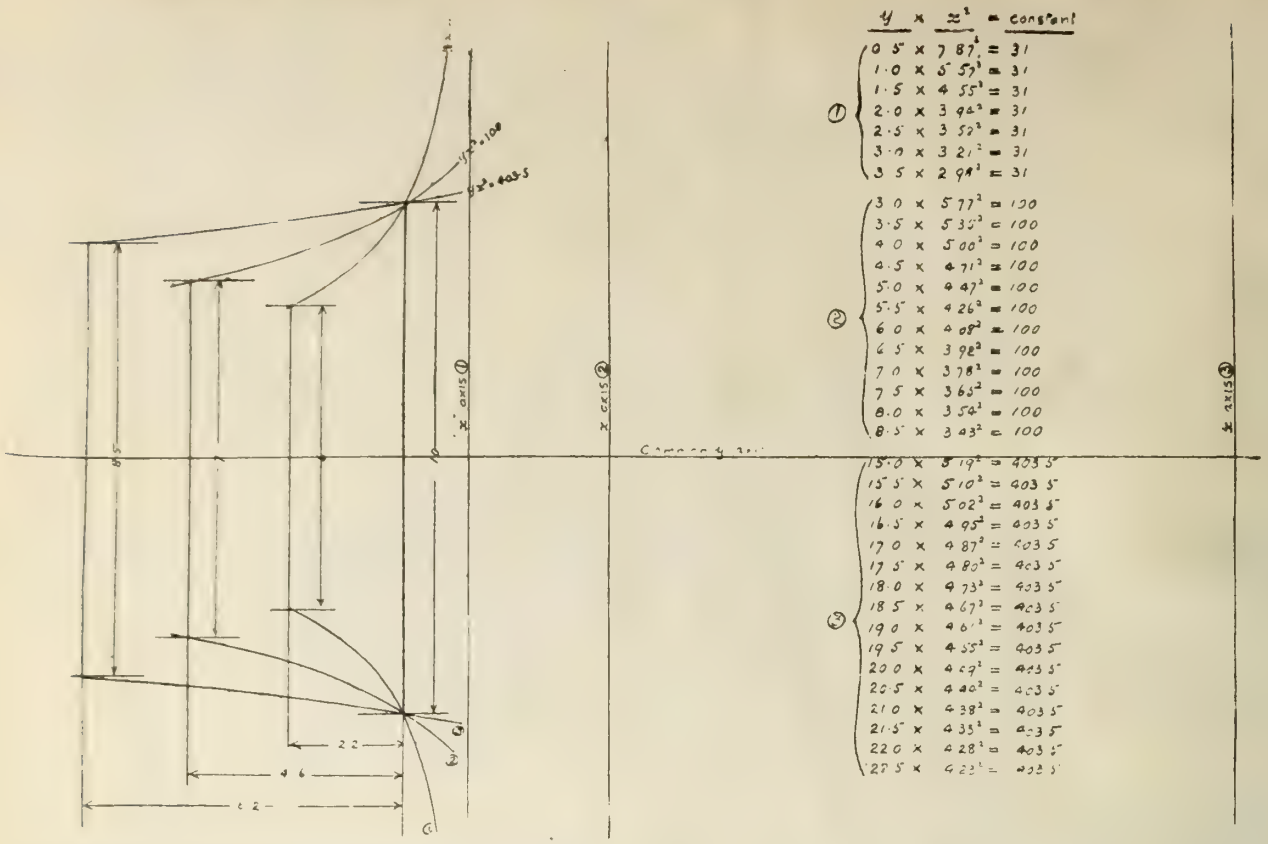


DIAGRAM SHOWING CONTOUR OF CONTRACTION OF WATER COLUMN BETWEEN PROPELLER OF 10 UNITS DIAMETER AND SMALLEST SECTION OF RACE, IN THE MEAN AND EXTREME CASES QUOTED.

peller, and postulate a theoretical "Actuator," which takes the place of the propeller and satisfies the conditions of rational analytical treatment of ideal cases.

The pressures (and consequently the velocities) obtaining around typical model screws are recorded in the diagrams plotted for a variety of experimental conditions in Admiral Taylor's work.

Considerable information is contained in a paper dealing with "Tests on Model Propellers," by Mr. J. L. Hodgson.

Sir Charles A. Parsons and Mr. S. S. Cook have proved that in the case of a water siren, which possesses certain resemblance to that of a propeller, the erosive effect of cavitation was eliminated by confining the tail race in a short nozzle; and, finally, several mathematicians have shown that propeller action can be accounted for by attributing its effect to certain forms of vortex flow.

Careful consideration of a mass of published theoretical and experimental work, dealing directly and indirectly with conditions of a fluid flow analogous to those obtaining in the region of a working screw propeller has led to the conclusion that this flow, in the immediate vicinity of the propeller, closely resembles that of a spiral vortex.

The screw propeller in operation imparts both axial acceleration and whirl to the column of water acted upon and the column contracts under its impressed velocity, while this action takes effect from some distance ahead of the propeller and extends to some distance astern thereof. A close imitation of a natural spiral vortex must therefore be formed in a portion of the column of water acted upon, disturbed only by the interference of the propeller itself.

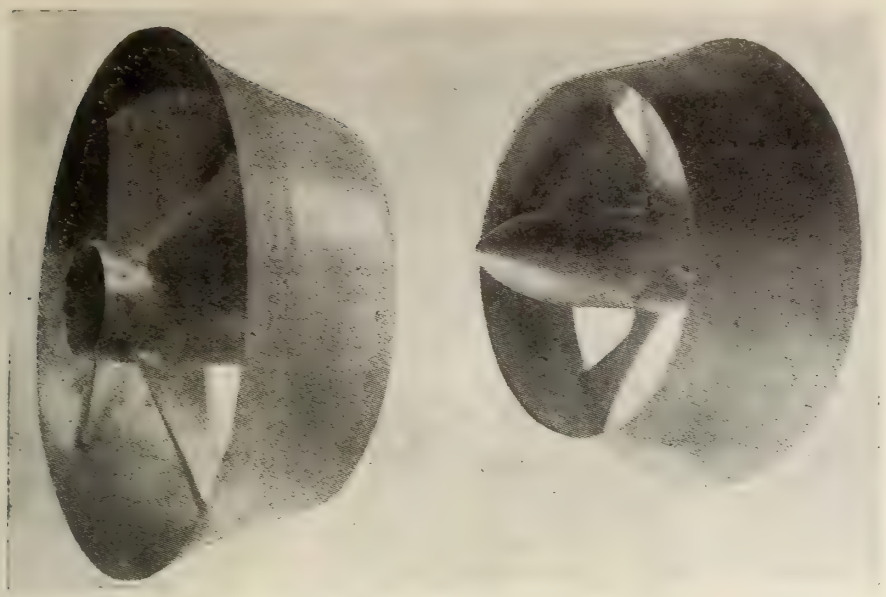
Further consideration of records of actual conditions obtaining in propeller race and in vortex flow indicates that, in order to prevent disturbance of what appears to be almost natural vortex action and also to obtain the benefit of a controlled tail race, which is found to result from the water siren experiments, it is desirable to surround the propeller by a nozzle shaped shroud of vortex contour, occupying the position of the "tube" referred to in Mr. R. E. Froude's conception of a theoretical "Actuator."

Experience gained with propellers operating near to, or closely surrounded by any fixed surface has shown that it is preferable to fix the shroud to the blade tips and make it part of the revolving propeller, at the expense of augmented external friction, rather than to incur the eddy losses obtaining between the blade tips of a revolving propeller operating at small clearance within a fixed shroud of any form. During the course of the investigation, photographs were taken of the actual flow of water through typical propellers under various conditions of operation, also of the flow conditions obtaining in spiral vortices, originated by mechanical stirring but allowed to assume natural conditions. The result of comparing the contours of the flow obtaining in these two sets of records was an extraordinary agreement between the curves of contracting flow under acceleration, in the two cases; and an analysis of the curves of contraction proved that semi-hyperbolic curves of the nature $y x^2 = \text{constant}$, fitted the conditions of flow through a working propeller equally with those obtaining in a natural vortex.

Before developing these analytical results, early experiments had been carried out with model propellers of 5 inches diameter by 4 inches pitch, both in an open or normal state and when fixed in nozzle shrouds of curvatures calculated for $a \times v = \text{constant}$, where "a" is the cross sectional area and "v" the velocity of flow, the shrouds being made of various lengths, and revolution speeds of values up to 3,200 per minute being employed.

The results of these experiments showed that at the same immersion and speed of current the shrouded screws absorbed slightly more power for the same revolution speed, did not take air from the surface so readily as did the open screws, could be run at much higher speeds of revolution without incurring fluctuations in the thrust, and produced a markedly less disturbed wake.

Further experiment proved that there was no measurable loss of power in the nozzling of the water stream, that the difference in power input for the same revolution speeds was accounted for by the surface friction outside the shroud, that this loss was considerably less than had been anticipated, that the shroud could be curtailed at the intake side without loss of efficiency, but was very sensitive to alteration of length on the discharge side, and that the curvature of shroud most nearly resembling the



FOUR BLADED VORTEX TYPE PROPELLER 8 IN. DIA. x 13 IN. PITCH.
LEFT—AFTER END. RIGHT—FORWARD END.

contour of a vortex produced the best results.

The theoretical conditions which appear to govern the design of a shrouded screw propeller were subsequently examined in detail, and the relations obtaining between shrouded propellers and correctly designed open screws for the same power input and revolutions, were investigated at considerable length.

The results of this examination can best be illustrated by taking the simple case of replacing a propeller of the normal open type, for which the horsepower input, revolutions, and conditions of working are known, by one of the shrouded pattern; though this illustration is only cited as a mean example and cannot be taken as applying to all cases.

An average taken of the recorded results of a large number of published and original experiments with typical model screws of pitch ratios varying from .8 to about 1.5, and working over a fairly wide range of slip, shows that, taking the diameter of the propeller as a unit, D, the total axial length of the disturbance due to the action of this propeller, on the intake side, amounts to about 1.5D, that the minimum diameter of the tailrace is about .7D and that this minimum section occurs at slightly over .4D astern of the mean plane of the propeller disc. The distance to which the disturbance extends astern of the smallest section of the race is not well defined, but it cannot be taken as less than about 2D.

Recorded results give values of from .6D to .85D to the diameter of the smallest section of the race, and place this smallest section at from .22D to .62D astern of the propeller disc; but the numerical mean of a number of reliable observations can be taken at .7D and .416D.

Now the result of recorded observation has indicated that the stream of water acted upon by the propeller contracts between the propeller disc and the smallest section of the race according to the mean values given above, and in accordance with a vortex shaped form of which the boundaries conform to semi-hyperbolic curves of the nature $yx^2 = \text{constant}$; the "y" axis being parallel to or coincident with that of the propeller shaft, and the "x" axis being at right angles thereto and somewhere ahead of the propeller.

Applying this information to the case of replacing an open propeller of 10 units diameter (the units being inches, feet, or any other linear measure) by a shrouded screw to work at the same horse-power and revolutions:

Propeller diameter D=10;

Diameter of smallest section of race .7D=7;

Distance of smallest section of race from mean plane of propeller face .416D =4.16;

Boundary curve of contraction of race from propeller diameter, 10, to smallest diameter of race, 7 (or hyperbolic curve passing through "x" ordinates $\frac{10}{2}$ and $\frac{7}{2}$ which are 4.16 apart on "y" axis) is found to have a constant value of $yx^2 = 100$, with the axes intersecting at a zero point 4 units ahead of D.

These data, on being plotted, evidently give the boundaries of the mean natural contraction of the stream of water acted upon, from the propeller disc to the smallest section of the race.

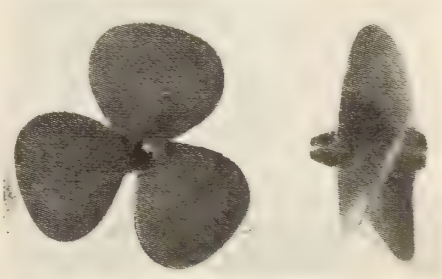
Now the area of any transverse section of this contracting column is proportional to the square of its diameter; therefore the area at D of 10 units diameter is to the area of the smallest section of the race, of 7 units diameter, as 100 is to 49; consequently, the axial velocity of the contracting column, which varies inversely as the area, has a little more than doubled in value between the mean plane of the propeller disc and the smallest section of the race, in the average case quoted. It therefore becomes apparent that the propeller of diameter D may be replaced by a smaller propeller, placed further along the race and bounded by the contracting column; but this smaller propeller must have axially increasing pitch, the pitch at any transverse section in the contracting column being related to the pitch of the original propeller of diameter D, inversely as the square of the diameter at that section is to the square of diameter D, without taking into account any angular variation in the whirl.

Experiment has shown, however, that this smaller propeller would derive little, if any, benefit from its theoretically correct increasing axial pitch, and would lose in efficiency by reason of churning effect, unless it be encased in a shroud. The contour required for such a shroud is obviously defined by the hyperbolic curve bounding the contraction of the column of water acted upon, and we thus arrive at the main features affecting the design of what may be termed the "Vortex" type of screw propeller.

It will here be instructive to consider a diagram which has been plotted, in accordance with observed results, to illustrate the nature of the curves bounding the contracting flow between the propeller disc and the smallest section of the race, in the mean case which shows a contraction from D 10 to D 7 in 4.16 of length, and in the two extreme quoted cases of D 10 to D 6 in 2.2 of length and D 10 to D 8.5 in 6.2 of length. The hyperbolic curves of the nature yx^2=constant, which have been observed to form the contour of the contracting column in the immediate vicinity of the screw, have the radii of the respective sections of this column as their "x" ordinates and the axial distances intercepted between these sections as the differences between the lengths of the corresponding "y" ordinates. The value of the constant for the equation to the curve of contraction in each of the cases named is readily determined from the radii at the propeller disc and at the smallest section of the race, taken in conjunction with the intercepted axial distance between these radii, after first determining the unknown "y" values, as follows:

For the Mean Case. (2.)

D 10 gives ordinate x=5 (and $x^2=25$).
D 7 gives ordinate $x_1=3.5$ (and $x_1^2=12.25$).
"y" ordinate corresponding to x=y
"y" ordinate corresponding to $x_1=y_1=(y+4.16)$.



TYPICAL MODEL PROPELLERS USED IN OBTAINING PHOTOS OF FLOW.

Then

$y \times x^2 = y_1 \times x_1^2$.

$y \times 25 = (y+4.16) \times 12.25$.

$y \times 2.04 = y+4.16$.

$y+1.04y = y+4.16$.

$$y = \frac{4.16}{1.04} = 4.$$

and $y_1 = 4+4.16 = 8.16$.

Substituting in $yx^2 = \text{constant}$.

$4 \times 25 = 100$
$8.16 \times 12.25 = 100$ } constant for curve.

For Higher Extreme Case. (1.)

D 10 gives ordinate $x=5$ (and $x^2=25$).

D 6 gives ordinate $x_1=3$ (and $x_1^2=9$).

"y" ordinate corresponding to $x=y$.

"y" ordinate corresponding to $x_1=y_1=(y+2.2)$.

Then

$y \times x^2 = y_1 \times x_1^2$.

$y \times 25 = (y+2.2) \times 9$.

$y \times 2.78 = y+2.2$.

$y+1.78y = y+2.2$.

$$y = \frac{2.2}{1.78} = 1.24.$$

and $y_1 = 1.24+2.2 = 3.44$.

Substituting in $yx^2 = \text{constant}$.

$1.24 \times 25 = 31$
$3.44 \times 9 = 31$ } constant for curve.

For Lower Extreme Case. (3.)

D 10 gives ordinate $x=5$ (and $x^2=25$).

D 8.5 gives ordinate $x=4.25$ (and $x_1^2=18.06$).

"y" ordinate corresponding to $x=y$.

"y" ordinate corresponding to $x_1=y_1=(y+6.2)$.

Then

$y \times x^2 = y_1 \times x_1^2$.

$y \times 25 = (y+6.2) \times 18.06$.

$y \times 1.384 = y+6.2$.

$y+.384y = y+6.2$.

$$y = \frac{6.2}{.384} = 16.14.$$

and $y_1 = 16.14+6.2 = 22.34$.

Substituting in $yx^2 = \text{constant}$

$16.14 \times 25 = 403.5$
$22.34 \times 18.06 = 403.5$ } constant for curve.

The hyperbolic contour of the contraction of the column of water directly acted upon is, however, shown by photographic records of the flow through propellers in operation, and also deduced from the curves of pressures existing around a working screw, to obtain only for a short distance ahead and astern of the propeller. The explanation of this fact appears to be that it is only when fairly close to the intake side of the screw that a whirling motion is imparted to the column of water acted upon and that immediately after the smallest section of the race is reached the column begins to expand under frictional retardation. The curves plotted from the foregoing data serve to exemplify the conditions obtaining in the cases of medium high, and low true slip and though it may be objected that definite boundaries assigned to the contracting column imply a fairly sharp demarcation between the velocity and pressure conditions obtaining for a short distance ahead and astern of the propeller, the fact that such a partition does exist in practice, appears to be definitely indicated by a number of experiments and by photographic records.

The length to which the shroud shall project beyond the leading edges of the blades in an axial direction, in order to counteract local eddies, and the length to which it shall project in an axial direction beyond the following edges of the blades, in order to secure a complete race column, are largely matters of experiment and experience, small departures from the provedly correct values, especially on the discharge side, having a very marked effect on efficiency. In the case, however, of a shrouded propeller of average dimensions replacing an open screw of pitch diameter ratio equal to unity, the normal overall length of shroud can be taken as approximately one-third of D.

The axially projected length of the blades is governed by the blade area required on the thwartship projection, by the necessary pitch, and by convenience of design.

As the shrouding of the propeller overcomes the practical objections to wide tipped blades, the thwartship projection of the propeller face can have blades with radial edges, and consequently with parallel edges in the fore and aft projection.

The blades may be raked, or even curved, to act squarely on the stream of water flowing through the shroud, though little practical advantage has hitherto been found to result from such a refinement; and in the case of the boss there is little if anything to be gained by making it other than cylindrical, though its after-end must be terminated by a streamline fairwater of not less than two diameters in length.

The shrouded type of propeller may be built up or produced as one casting, both methods having been employed in practice, and, as the blade sections can be made thinner than those for an open screw and the diameter be also reduced, the extra weight of the shroud is largely compensated for.

Before considering the advantages to be obtained by the use of the shrouded type of propeller outlined in this paper, it will be well to consider the objections which have and may be advanced against it, for the reason that any such apparent innovation must necessarily be examined in a critical spirit by those versed in the art to which it applies, and must inevitably be deprecated by many whose vested interests or personal convictions are affected by a departure from accepted practice.

The particular design of propeller referred to herein is not the subect of any startlingly original invention, but merely results from collecting and applying known facts, and permissible deductions therefrom, to the solution of a definite problem. Its justification lies in results and conclusions recorded in the writings of masters of the art and in the actual experimental data obtained by observing, photographing, and analyzing the flow of water through propellers of different types.

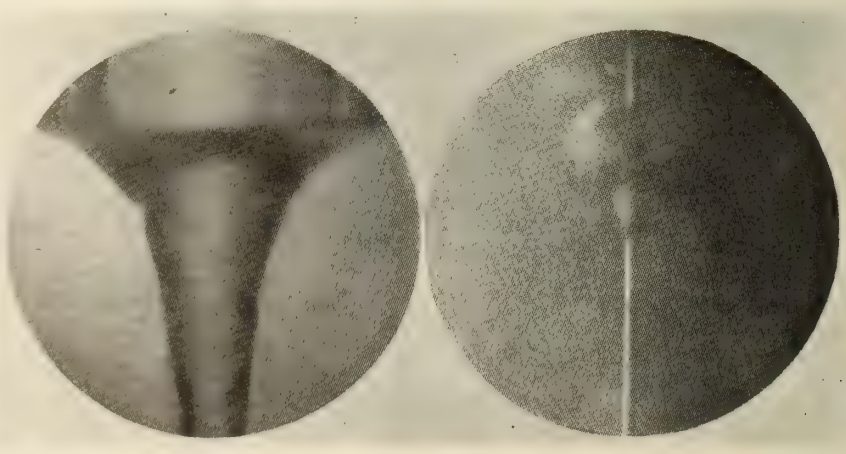
Some of the chief objections raised, and the ways in which they may be met are briefly summarized as follows:

Objection. The shrouded type of propeller has been tried previously and has failed.

Reply. Careful search through Patent Office records, published papers, and books on propellers and kindred subjects, has failed to disclose any previous attempt to apply a correctly designed nozzle shroud fixed to and rotating with the propeller. There have been failures with encased propellers of certain types but none recorded with the type now put forward.

Objection. Skin friction on the shroud renders the design incapable of competing with the open propeller.

Reply. There is undoubtedly skin friction on the shroud, but it is not found to increase according to the square of the velocity of rotation, as was predicted; nor is it similar to disc friction with the eddy making effects inseparable therefrom. Furthermore, the surface of the shroud is easily machined to a high degree of smoothness, and the frictional loss can thus be reduced to a minimum; witness the case of the shrouded impeller commonly employed in centrifugal pumps.



LEFT—NATURAL SPIRAL VORTEX IN REFRACTION FREE WATER CELL. RIGHT—TYPICAL MODEL SCREW OF OPEN PATTERN ROTATING IN WATER STREAM. NOTE COINCIDENCE OF SWIRL AT INCOMING SIDE OF SCREW TOP WITH THAT IN NATURAL VORTEX.

Objection. Attaching a contracting nozzle to an advancing propeller is similar to towing a "drogue" through the water.

Reply. This would be true if the nozzle were not doing useful work in consolidating the race column and preventing radial flow. Also the reduced pressure due to velocity of flow within the shroud implies an excess pressure on the outside of the shroud where the water is not axially accelerated, this pressure having a resolved component of forward thrust on the outside of the shroud.

Objection. A greater proportion of total acceleration of the fluid stream acted upon takes place ahead of the screw and a less proportion astern of the screw than in the case of the open propeller acting upon an equal volume of water per revolution.

Reply. This is true when replacing an open screw by one of the shrouded type of smaller diameter, as would usually be the case, but it must be recollected that the Kinetic energy remaining in the race after the water has left the propeller, is wasted as far as propulsion is concerned. It is therefore probably advantageous for the propeller to work near to the smallest section of the race, instead of allowing a large proportion of the total acceleration and consequent contraction of the water column to take place astern of the propeller, as in the case of most open screws.

Objection. The relatively large and axially increasing pitch employed in the shrouded screw will produce excessive rotation of the race, the energy from which could only be recovered by fixed guide blades astern of the propeller.

Reply. This is partly covered by the reply to the previous objection, which deals with the desirability of acting upon the water column near to its smallest section, while the fitting of guide blades astern of the propeller, though of apparent advantage with some types of screw, introduces additional frictional surface at a position where the water stream has a high velocity.

Objection. The shrouded propeller, replacing an open screw of larger diameter, will be working at a higher slip.

Reply. The shrouded propeller will normally be working on the same water column but nearer to its greatest contraction, and it appears that the true slip, or velocity with which the water column is projected astern, does not attain its full value till the minimum race section is reached. This may account for the fact that in certain cases an improvement in performance is secured by reducing the diameter and increasing the pitch of open propellers, and at any rate indicates that in certain cases a high true slip need not necessarily imply an unfavorable overall efficiency. Additional proof of this is furnished by the good results obtained with shrouded propellers in towing, which is generally accepted as the most unfavorable condition for small diameter screws of large pitch ratio.

Objection. The curvature of any one shroud, following an assumed contraction of racecolumn is only correct for one particular condition of true slip.

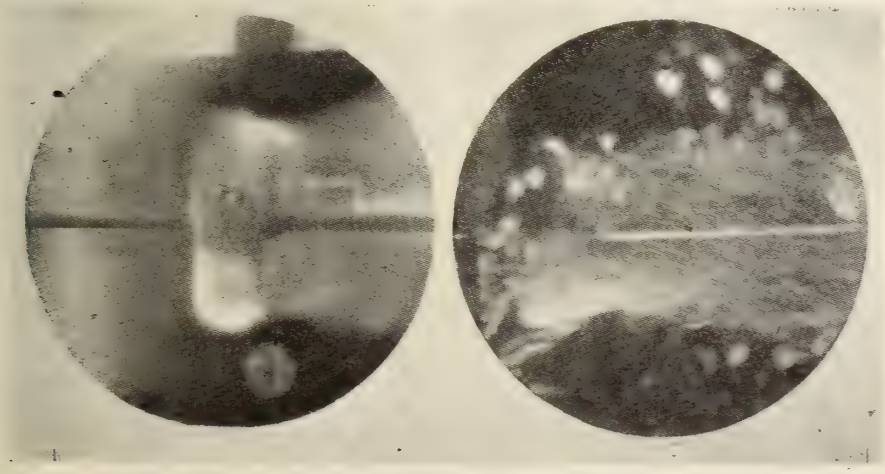
Reply. This is correct, but the same argument applies to any other type of screw propeller, in that the best efficiency is attained at one particular slip value under working conditions. In the case of a properly designed vortex type shrouded propeller it must also be recollected that the acceleration of the fluid stream consequent upon the axially increasing pitch, and the contraction of area in the shroud, are correctly proportioned one to the other.

Objection. Stern-going power must be poor or even totally absent.

Reply. There is no apparent reason why the nozzle shrouded propeller should not operate in going astern practically as an open propeller of diameter equivalent to the outlet from the shroud. Here again actual trials have proved that the stern-going power of the nozzle shrouded propeller is quite satisfactory.

Objection. Floating objects may become jammed in the contracting shroud.

Reply. This is considerably less likely to occur than that the blades of an open propeller should be damaged by such objects and the shrouded screw is less likely to pick up ropes, nets, etc., than are the blades of an open propeller.



TYPICAL MODEL SCREW OF OPEN PATTERN ROTATING IN WATER STREAM. LEFT—AIR INJECTED TO SHOW CONTRACTING FLOW FROM INTAKE RIGHT TO TAIL RACE LEFT. RIGHT—POWDER INJECTED FOR SAME PURPOSE.

Objection. The weight is greater than that of an open propeller.

Reply. The diameter is normally made smaller than that of the open screw, which partly disposes of this objection; the blades may be made thinner and correct balance is easy to attain.

Objection. The manufacturing difficulties and cost are greater than in the case of an open propeller.

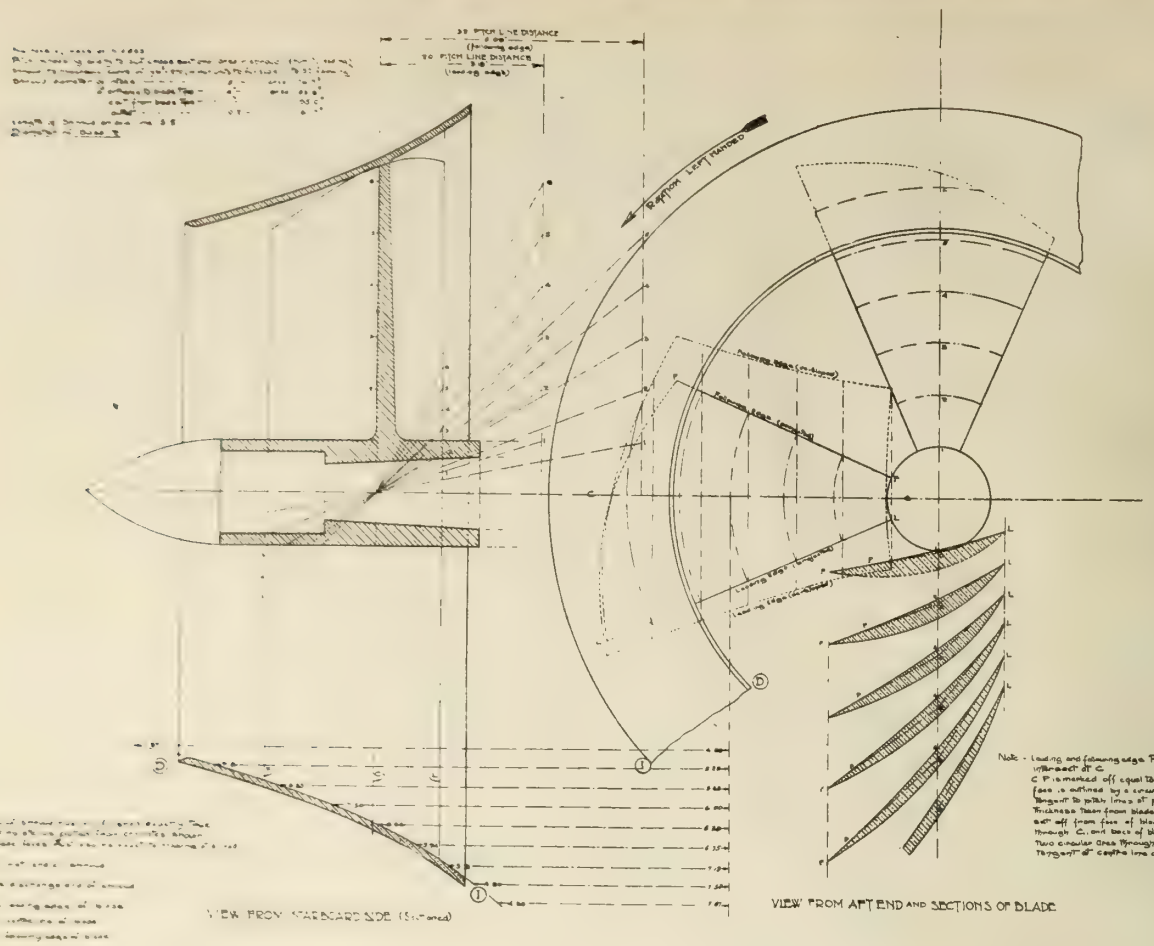
Reply. This is quite correct, but the process of manufacture is not a difficult engineering problem with appliances of comparatively simple design, and the cost is offset by maintenance of pitch under conditions of service, and certain advantages gained.

Some of the theoretical and practical advantages which it is possible to obtain by the use of a screw propeller of correct design, carrying a nozzle-shaped shroud of suitable form, may now be considered:

In the first place, the accepted facts are that the purpose of the device is to develop a propulsive reaction by continually pushing a mass of water astern; that the instrument employed for this service consists of from two to four short inclined planes mounted on the end of a revolving shaft whose axis lies in the direction of the required resultant reaction; and that the instrument must necessarily impart a whirling motion to the water in addition to giving it an axial acceleration.

Now, when nature whirls and accelerates a fluid stream, the balance of pressures and velocities is arrived at in that particular form of flow which is known as vortex action, and this may be accepted as being produced with a minimum input of energy. There is obviously a parallel between propeller action and the condition obtaining in natural vortex flow; and, though it must be admitted that nature does not institute and maintain a vortex by rotating a fluid at one point through the medium of a crude device like a propeller; also that the propeller will necessarily cause disturbances which militate against true vortex flow; and furthermore that nature does not produce a vortex with the object of developing propulsive reaction; yet the general conditions of flow are similar, and the observed agreement between the flow through a working propeller and that in a natural spiral vortex is remarkable and convincing.

Having arrived at this stage of the argument the logical deduction is that, when designing a propeller, means should be adopted to imitate the natural condition of vortex flow, the necessary precautions evidently being to employ axially increasing blade pitch, in conformity with the natural acceleration of the stream operated upon, and to counteract radial flow and other disturbing factors, so far as possible, by encasing the propeller in a shroud of suitable contour. This is the object aimed at in the design of a "Vortex" type shrouded screw propeller, and



as each blade comes uppermost; and air is consequently not so readily taken down at light draft.

The "helm" or "clawing" effect of the propeller, tending to swing the stern of the vessel, is materially reduced. The effect of acceleration on one side, and retardation on the other side, of the propeller, when "pitching" or "scending," is practically eliminated.

When towing, or otherwise working at a high true slip, the water is dealt with as by an axial flow pump, and "churning" is materially reduced.

The blades of the propeller, being supported at both ends, may be made thin, the increasing pitch tending to stiffen them; and they are well protected from damage due to ice, floating obstructions or grounding.

The "out of pitch" effect, which obtains when an inclined shaft is installed, is practically disposed of.

Propellers of smaller diameter may be employed, and experiments indicate that higher revolution speeds can be adopted, which may result in modification, or in certain cases elimination, of reduction gearing.

No extravagant claims for increased speed, reduced fuel consumption, etc., are made, nor is it contended that one shroud contour fits every condition.

There are also cases in which the open type of screw will undoubtedly be preferred.

practical results appear to justify the theoretical basis of the design.

The water is constrained to flow through the propeller under conditions which appear to be those indicated by natural laws.

The eddy effects which obtain when the tips of propeller blades operate close to a bounding surface are avoided by rotating the shroud with the propeller.

Axially increasing pitch can be employed with certainty and advantage.

Wide tipped blades can be employed without the penalty of vibration.

The race column is a complete stream instead of being a disturbed discharge.

The localization of pressures is minimised with resulting reduction in what may be termed "incipient cavitation."

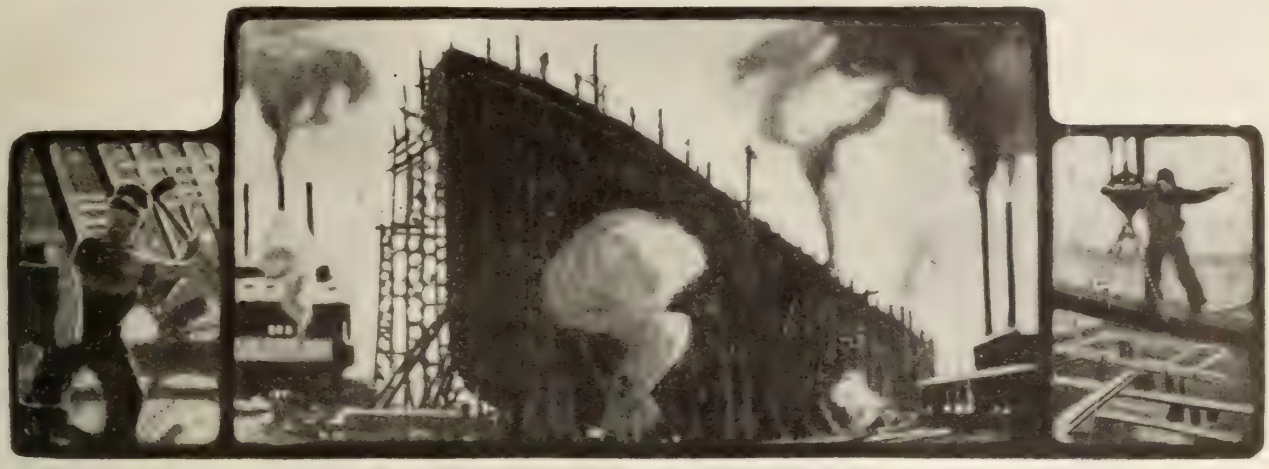
There is a region of constant but reduced pressure around the intake to the propeller shroud instead of there being localized areas of reduced pressure behind the blade tips, approaching and receding from the surface of the water

It is admitted, however, by those best qualified to express an opinion that there has been little practical advance in the evolution of the screw propeller during many years past, in spite of changing conditions, and this paper is submitted to the consideration of marine engineers as indicating the broad outline of a design, which both theory and experiment appear to justify as a rational solution of the high speed and small diameter propeller problem.

A WOOD PRESERVER

By a theory now being developed at the United States Forest Products Laboratory, it would seem reasonable to expect that any material which is poisonous enough to kill an organism of any kind must necessarily be soluble in the body fluids of that organism, and the chief body fluid of timber-destroying fungi and wood borers is water. Wood preservatives now in use are of two distinct types—inorganic salts, such as zinc chloride, which are very soluble in water; and oils, such as creosotes, which are generally considered to be insoluble. The solubility of creosote is usually considered so slight as to be neglected, but experiments indicate that certain constituents of creosote are sufficiently soluble in water to make it poisonous for wood destroyers. Creosote oil may therefore be considered as consisting of two groups of compounds, one of these being sufficiently soluble in water to render it toxic; the other insoluble in water and hence not toxic. The non-toxic oils act as a reservoir for the toxic oils and feed them slowly to the moisture in the wood. Zinc chloride has no reserve supply, all the material being soluble in the usual amount of moisture present in air-dry wood. Creosote oil may have a considerable reserve supply stored in the oil itself, this supply being fed to the wood as needed.

Looking Over the *Shipping* Situation



By T. H. FENNER, Editor Marine Engineering of Canada

LOOKING back over the past twelve months' activities in the maritime world they cannot be said to have been without interest, in fact in some ways they have been spectacular, but have gradually been slowing down as the year wore on, until now shipping has entered the doldrums. How long it will tack about there before catching the first whisper of the wind of prosperity, depends upon a number of factors, the chief and most uncertain one being the time when the world will settle down to work and produce.

The expected slump in freight rates has materialised, and as the writer has pointed out in previous articles, the more inexperienced among the operators of shipping have felt the pinch the most. At the same time, passenger rates have kept up their previous high level, and have in many cases advanced, and that they will keep this advance up, is most probable. The conditions governing in the freight world are altogether reversed in the case of the passenger vessels. In the shipbuilding trade, work is also falling off, after the gigantic efforts put forth by various nations during the past two years, and in many cases plants which cost millions to put down are practically abandoned, and of no use to anyone at the present time. In Canada, the year has been marked by the failure of some of the yards, and the prospects for the future are at the moment, none too bright. The position of shipping all over the world is that of passing through a period of depression, and its effect is shown in falling freights, cancellation of building contracts, and in the laying up of vessels to wait for better times. The passing of the legislation known as the Jones Act in the United States was attended with much excitement, but inasmuch as its provisions have not yet been put into force, and are probably destined to be shelved, matters are being left in status quo for the meantime. The United States Shipping Board has at the moment probably enough troubles on its hands to suit even its fire-eating chairman, Admiral Benson, who has been reappointed. France has found the possession of a Government owned fleet not an unmixed blessing and is considering ways and means of getting rid of it to private owners. The blighting hand of the Government is being gradually moved from British shipping, but the Ministry of Shipping still survives, much to the disgust of the shipowning fraternity, who are anxious to be unfettered in their efforts to rehabilitate themselves. If the events of the past twelve months have shown one thing more clearly than another, it is that a Government is incapable of carrying on a commercial adventure such as operating ships or railways. The good showing of the C.G.M.M. up to the present has been largely due to the fact that practical shipping men were appointed to the executive positions, and the Government left the management of the fleet in their hands. The management have shown their strong commonsense by linking up the C.G.M.M. with some of the strongest and most powerful lines in the old country, by which arrangement they are sure of the best facilities in the various ports abroad and in the U. K., and are also assured of valuable feeders for cargo at outside points where a new line would have great difficulty in getting a look in. Such is the general state of affairs at this time of writing, and it will be profitable and instructive to look a little more closely into details.

The World's Tonnage

We have heard a great deal of late about the tonnage of the world being greater than in the pre-war days of 1914. This is true, but it does not take into account the natural increase that would have taken place in normal times, nor the fact that a lot of tonnage is very old, and in some cases almost obsolete. There has been a very large amount of reconditioning carried out during the past year, many vessels which had no overhaul during the strenuous days of the war having been taken out of commission and re-fitted completely. Another feature is that for a long period following the armistice the efficiency of the shipping in use was very low.

This was due to congestion in the various world ports, necessitating long waits for unloading, and loading again. The congestion was caused in a great measure by restrictive methods pursued by labor, and by the natural difficulty in clearing warehouses and storage sheds from the accumulation of merchandise that had piled up during the period of Government control. The breakdown of land transportation during the same period contributed also to the general tie-up.

This condition is being cleared up now, but is still bad in spots. The result of all this was that many ships were actually in their loading and discharging ports for a greater period than they were actually on the voyage between ports. This meant that there were too few ships to carry on the business, and the costs being so high, freights went up by leaps and bounds to cover these extra costs.

Owing to poor fuel, and general rundownness, ships took longer to cover the same mileage than in normal times, and

all these factors contributed to make the efficiency of the merchant fleet very low. Another point is that a large percentage of the increase in the world's tonnage is represented by wooden vessels, which are mostly tied up at the present day, and represent a dead loss to their owners. The United States Shipping Board possesses about $200,000,000 worth of these vessels, which they can neither operate, sell, or even give away.

What the Figures Show

Comparing the figures for 1914 with those of the present day we see some points of interest. The totals are taken from Lloyd's Register of Shipping, which is the world authority on the matter. Vessels of less than 100 gross tons are not included, neither are warships. In 1914 the world possessed a total of 45,404,000 gross tons. The total in June, 1920, was 53,905,000, or a total increase of 8,501,000 tons. The relative position of the great shipowning nations has materially altered. For instance, in 1914 the United Kingdom had 18,892,000 tons, while the United States had only 4,287,000, including all her Great Lake craft. The percentage of the world's tonnage owned in the United Kingdom was 43.9, while that of the U. S. was 4.7. At the present day the percentage of the United Kingdom has decreased to 35.1, while the United States has increased to 24. The increase in the other countries has practically all taken place since the closing of the armistice, during which period the increase in the world's shipping has amounted to over 6,000,000 tons. By carefully estimating the net increase in the tonnage of the various nations, and eliminating all wooden and iron tonnage, the compilers of the Registry arrive at the conclusion that the world is still 3½ million tons to the bad as far as steel steamers are concerned. This effectually disposes of the claim that there is too much tonnage afloat.

Great Britain Still Building

The outstanding feature of the shipbuilding situation has been the increase in the number of vessels now under construction in the United Kingdom, and the decrease of those under construction in the United States. The building programme of the U.S. is now about finished. The same thing applies to the construction in Canada.

The following figures for the quarters ending March 31, June 30th and September 30th will give a good idea of the progress of events. There is no doubt that the immense amount of reconstruction work undertaken in the United Kingdom, as well as the dilatory attitude of labor, has kept production of new tonnage down, but even at that a very steady increase is noted.

In the quarter ending March 31st, the amount of new construction under weigh in the United Kingdom was 3,394,425 tons. This was made up as follows: 814 steel steamers, 7 ferro-concrete, and 4 wood and composite steamers. There were also 35 steel sailing vessels, 4 ferro-concrete vessels and one wood and composite ship. In the United States at the same date there were 450 steel steamers, 29 wooden steamers, 10 steel sailing vessels, and 46 wooden sailing vessels, or a total of 535 vessels of all kinds, with a total tonnage of 2,573,298 tons. In Canada at the same date there were 50 steel steamers, or a total tonnage of 157,000 tons under construction.

Many Large Carriers Built

A notable feature of the steamers under construction in the United Kingdom was that there were 62 steamers of over 10,000 tons included. These were made up of 10 between 10,000 and 12,000 tons, 29 between 12,000 and 15,000 tons, 20 between 15,000 and 20,000 tons, and 3 between 20,000 and 25,000 tons. These vessels were mostly of the purely cargo, or the combined cargo and passenger type, very few companies building the purely passenger liner class of vessel.

In the following quarter, that ending June 30th, the figures altered to the advantage of the United Kingdom; steel steamers were 888, ferro-concrete 3, and wood or composite 4. The sailing vessels were, steel 41, ferro-concrete 3, and wood or composite 2. The tonnage represented was 3,388,000. In the United States the steamers had fallen to 366 of steel, 18 of wood, while the sailing vessels were 15 steel and 16 wood. The total tonnage represented was 2,105,956. In Canada the tonnage under construction was 58 steel steamers, and 12 wooden steamers, and 14 wooden sailing ships. The total tonnage was just over 200,000. In Great Britain the steamers over 10,000 had gone up to 63, nine of them being between ten and twelve thousand, thirty-one between 12,000 and 15,000, the remainder being the same as in the previous quarter. The peak of Canadian building for the year had been reached in this quarter, as the next quarter shows a drop in the number and tonnage of the vessels on the stocks and being completed.

THIS VESSEL MARKED A GREAT DEVELOPMENT IN SHIPBUILDING. SHE IS ENTIRELY ELECTRIC WELDED AND FITTED WITH AN OPPOSED PISTON INTERNAL COMBUSTION ENGINE DESIGNED BY CAMMEL, LAIRD & CO.

The figures for the quarter ending December will of course show this still more, but they are not yet available.

What Other Periods Show

The quarter ending September 30th shows a still higher figure for Great Britain, and a further drop in the U.S. Thus the steel steamers in the United Kingdom numbered 912, ferro-concrete 5, and wood or composite 4. Their total tonnage was 3,720,000 while sailing vessel tonnage made another 11,000.

United States figures are 260 steel steamers, with a total tonnage of 1,734,000, wooden steamers being 12 of 18,000 tons and ten each of wooden and steel sailing vessels of 18,000 tons. There is thus a considerable decrease in the number and tonnage of all vessels building in the United States. In Canada the number of steel steamers had decreased to 46, with a tonnage of 158,000, three wooden steamers with a tonnage of only 1,057, and 15 wooden sailing vessels of a tonnage amounting to 11,000. Thus the figures show the gradual rise of British shipbuilding and the falling off of United States shipbuilding. The cause of the decrease, both in the U. S. and Canada is of course the completion of the Government building programmes. The United States now has a fleet of sea going merchant vessels operated partly by the Shipping Board and in part by private firms who have been allocated tonnage by the board. A large number of the vessels which were under private management have been handed back to the Shipping Board since the freight market fell in, and the Board has laid up a large number of their vessels which they have been unable to fix.

The United States Merchant Fleet

Probably the events of most interest in the year's operation of the new merchant marine in the United States, has been the passing of the Jones Act and the investigation of the Shipping Board. The Jones Act is the name given to the legislation introduced by Senator Jones, which had as its avowed object the bolstering up of the new merchant fleet against competition by the nations which were doing the most of the carrying trade. Chiefly, it was directed against Great Britain. The untoward events of the last five years having resulted in Great Britain losing a great portion of her shipping in the service, and for the benefit of the rest of the world, and the United States having become possessed, at enormous expense, of a more or less efficient fleet, it was felt by the Senator and those associated with him, that something had to be done to ensure its ability to live. Legislation passed in former years by Senator La Follette has resulted in making the ships of the U. S. the most expensive in the world to operate. This was on account of the extraordinary accommodation and living standard set for the U. S. seaman, and when this was coupled to the necessity of paying overtime for every little job that was done out of the regular routine, running ships at a profit even during the era of high freights was a problem.

It was not an uncommon thing for a Shipping Board vessel to arrive in a United States port with the bill for overtime to the crew totalling more than the actual wages, which themselves are very high.

Preference for U. S. Shipping

The method employed and backed by Admiral Benson, chairman of the Shipping Board, was to pass legislation by which all goods imported or exported to or from the U. S. in American ships should receive a preferential rate on the railroads, and also a preferential tariff. This meant that treaties in force with some twenty-nine other nations would have to be abrogated before this legislation could be put into operation. President Wilson, who even if he is an idealist, has a larger view than some of the U.S. senators, refused to give his assent to the bill, and it has hung fire ever since. It was not universally acclaimed even in the United States, the port of Seattle registering a very violent protest against its adoption. In reply to this Admiral Benson issued a statement that the protest was engineered by alien enemies of the United States, who wished harm to the new fleet, and threatened the port of Seattle with drastic punishment if their protests did not cease.

The claim of the Western seaport was that the bill, if put into effect, would ruin their trade. However, Admiral Benson has been made Chairman of the reconstituted Board, and with the coming into office of a new administration, pledged to further the interests of the U. S. mercantile marine against all comers, there will likely be some interesting developments in 1921. It is noteworthy that the British shipping press hail with satisfaction the reappointment of the bellicose Admiral, as if they feel that no worse harm could come to the Shipping Board fleet than having him in control.

What the Inquiries Showed

The investigation into the activities of the United States Shipping Board was undertaken by two former officers of the Board, and they have so far found that the Board committed everything but murder. Such things as incompetency, ignorance, graft, etc., are charged in connection with all its activities, and if half the charges are true, one can only sympathize with the great American nation. If half the blunders and mistakes that are charged could be committed by any body of presumably big business men in that land where efficiency is supposed to roost on the same perch as the eagle, how ever could any ordinary body of men be expected to succeed? The British press, which is naturally highly interested, is of the opinion that a lot of the charges are due to pre-election vigor. They take the view that when a totally inexperienced body like the U. S. Government take on a job like the building and operating of a huge merchant fleet, there were bound to be lots of mistakes, and the charges of graft they dismiss as due to the zeal of the investigators.

Competition Has Cut Rates

The vessels of the fleet have been put on various routes during the year, and have been in some cases responsible for the lowering of rates at a sudden clip. For instance, during the coal strike in England, when a new business in export coal sprang up suddenly from the Virginia ports, the board put such a number of ships on the trade that freight rates dropped rapidly. They also insisted on seeing the charter of any ships other than their own, American or foreign, so that they were in a position to know just what everybody else was doing, which of course gave them a considerable advantage. The deal by which Mr. Harriman has arranged a service between Hamburg and New York in connection with the old Hamburg-American line was consummated under the supervision of and with the consent of the Shipping Board. This gives the ships of the American corporation the advantages of Hamburg-American organization in Hamburg, but it also, in the opinion of a large number of people, gives the Hamburg-American line the entering wedge which they are looking for, in resuming active competition with the vessels of their erstwhile enemy. It is rather a peculiar thing that with the country still technically at war with the U. S., business arrangements can be made between German and American citizens, with the active help of a department of the American Government.

British Shipping

British shipping has been fighting its way back to its old time trades against a combination of handicaps which might well discourage any industry. The shipowners have been put to all kinds of inconvenience and expense by Government departments, notably the Ministry of Shipping, which having been created during the war, is doing its best to perpetuate a useless life. The Government has promised that its activities will shortly be discontinued, but it still drags on, and affords a proof if such were needed, of how hard it is to make men give up the easy hours and emoluments of a Government position, even when there is no possible excuse for their retaining them. The large liner companies have been reconditioning their ships, and getting them back on the routes, but it is notable that no companies are going in for the large fast passenger liner. Costs of building and operation have increased to such a point that the liner de luxe is a commercial impossibility.

Change in "Style" of Vessels

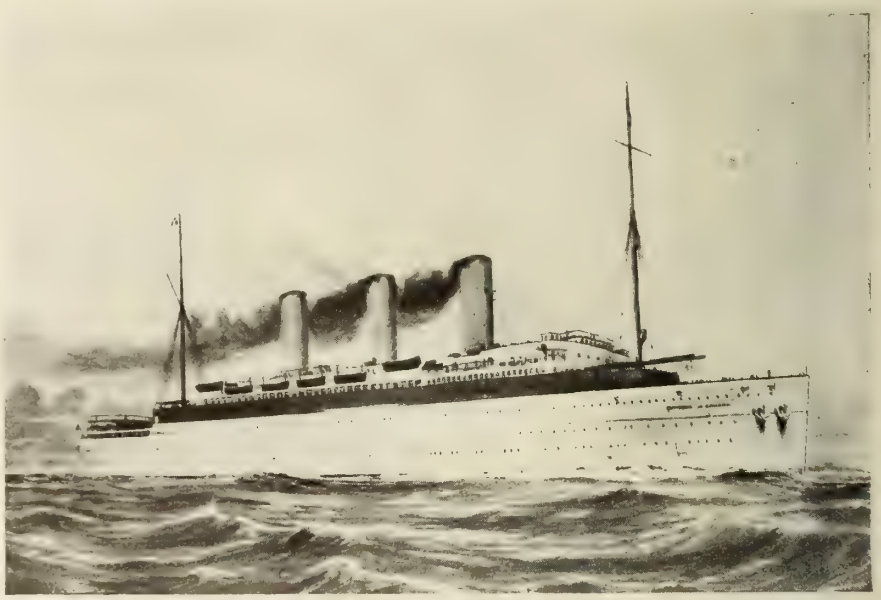
The type of vessel in favor now is the moderate size and moderate speed vessel that can give good accommodation to a fair number of passengers while carrying a large cargo. The shipowning business has been very badly hit by the low production of coal, and the embargoes placed on the export of coal to foreign countries, and the export of bunker coal. It is of course well known that the bulk of the steamers leaving England in the past have had cargoes of coal, which they took to all parts of the world, bringing back the produce of those countries. The coal formed outward freight and also created credits to pay for the goods brought back to the United Kingdom from other countries. The attitude of the coal miners in restraining production of coal, and the vexatious delays and restrictions placed on steamers by the Government department which has control of coal, has resulted in vessels having to leave England in ballast, to make long voyages in many cases, in order to get a return cargo. This resulted in high freight rates, which made the price of all goods brought back still dearer to the people in England.

During the coal strike, coal was actually imported to Britain, but worse still, the market in France and the Mediterreanen which had always been supplied by Britain was opened to her competitors.

Building Costs are Away Up

Costs of shipbuilding have gone to such a pitch that many firms have paid large sums to cancel the contracts for ships they had under construction, rather than continue with them and have to pay an exorbitant price. With falling freights, it is impossible to run the ships at a profit when the capital cost is abnormally high. In this connection some very straight words have recently been delivered to the workmen in the British yards. They have been told plainly that they are hanging back and not delivering an hour's work for an hour's pay, and that if this continues they will soon be without a job of any kind. A very serious side of the high cost, and not only the high cost, but the altogether unnecessary length of time taken is that it has resulted in a large amount of repair work being sent to the Continent that should have been done in the United Kingdom. A number of contracts for ships received from Norwegian and other foreign shipowners have been cancelled, but this is probably not so much a matter of high costs, as the slump in freights, which makes it appear a bad time to acquire new tonnage. At a recent launch of a Cunard steamer, the Chairman of the company said that the vessel was six months late in delivery, and had cost in excess of her estimated cost a matter of nearly $3,000,000. This sort of thing is naturally a big handicap. There is one thing that is to be said as far as the British shipowners are concerned, they have been through hard times before, and know just how to face them, and where to squeeze a living for a ship if it can be done.

If labor will assume anything like a reasonable attitude, especially the men actually sailing the ships, Great Britain will pull through the present depression in better shape than most of her competitors, and be on hand when the good period comes round again. There is no doubt that if the world in general were functioning properly, there would be ample work for all the ships at present afloat, and for a good many more. The elimination of a huge country like Russia from the trading field of the world has had a disastrous effect on many other countries, and the low rate of foreign exchange has also been a handicap on trading. British shipowners generally ask for nothing but a relief from the irritating restrictions of incompetent and stupid Government officials, and then they feel they can meet competition as they have hitherto done, and beat it.



ONE OF THE LATEST C.P.O.S. EMPRESSES—THE "EMPRESS OF CANADA."

Canada's Shipping and Ship-building

The past has been a busy year for Canada, both in her shipbuilding yards and on the high seas. Besides the ships that have been built for the Canadian Government Merchant Marine there have been a few built for export, and there is no doubt that there could be more export orders secured if there was any method of overcoming the exchange rate handicap. It has been rumored on several occasions that large orders have been secured for vessels for export, but these have not materialized. A suggestion was made during the year that the Government should finance the building of ships for foreign order, taking a mortgage on the vessel as security. This was finally agreed to by the Government, but up to the present no orders have materialized under this arrangement. Shipbuilders claim that the proportion of the cost of construction that would be advanced by the Government should be about 50% instead of the 25% they suggest. At the present time building is active at Halifax, Levis, Three Rivers, and Port Arthur and Collingwood. Some of the Pacific coast yards are also building vessels.

At to the outlook for the future we quote the opinion of one of the leading men in the industry, which should be of interest as coming from a practical shipbuilder, who knows whereof he speaks. The gentleman in question is Mr. C. M. Gillam, managing director of Canadian Vickers Ltd., who speaks as follows:

"During the past year the supply of materials, especially steel, was considerably handicapped by the labor troubles in the States in the railroad and mining industries, but this condition has much improved in the past few months. The tendency now as regards prices is downwards in practically all commodities. The supply of materials is distinctly good and promises to improve.

"There is an ample supply of labor and its efficiency has shown a steady improvement, although the wages, which gradually increased during the past years to meet the increased cost of living, still remain at a high figure. In this connection it is confidently hoped that as the cost of living improves the saner elements in labor will be able to guide their less informed brothers, realizing that a reduction in labor costs is essential if business is to be obtained in competition with European countries.

"In the shipbuilding industry there is a serious falling off in the number of employees, due to lack of orders for 1921. The cause of this is the adverse exchange rate and the fact that the Canadian Government shipbuilding programme has come to an end. There is no market in the

United States for Canadian built ships due to the financial inducements offered by the United States Government to United States owners to build their vessels in the States. The consequence is that the only market for Canadian shipbuilding at present is Europe and, as stated above, the exchange rate is sufficiently high to prevent business.

"With reduction in prices of materials and increasing efficiency of labor, prices asked for in Canada for ships are steadily coming down, and it is confidently predicted that, with the further reduction, both in wages and materials, anticipated in the near future, such prices will be so reduced as to enable Canada, apart from the exchange question, to compete to advantage in the open markets of the world. This is the only feature which justifies the hope that, as exchange becomes normal, there will continue to be a limited shipbuilding industry in Canada which can operate on a commercially sound basis.

"It should be noted in this connection that the cost of construction of ships in Canada is not materially higher than the present cost in England when the exchange situation is left out of account, although it must not be forgotten that there will undoubtedly be a tendency towards cheaper production in England when labor conditions there become more settled, although there is no likelihood of wages in Great Britain ever being reduced to pre-war rates.

"It is worthy of note that, roughly speaking, 50% of the business of Canadian Vickers, Limited, in shipbuilding has been for export, and the performances of ships built by them for foreign countries has more than justified the confidence in the ability of Canadian workmen and Canadian shipbuilders to turn out ships in all respects equal to those of any other country.

"The outlook for 1921 is not bright at present, so far as shipbuilding is concerned, but the basic factors, namely—efficiency of labor, the drop in price of materials, and the recognition by labor of the economic situation and willingness on their part to co-operate to overcome the adverse features, are such that a pessimistic cessation of effort to overcome these difficulties and to tide over the dull period is not justified, but a more vigorous attempt is necessary on the part of the Government and employers towards finding means by which the industry may be kept alive until exchange becomes normal and the Canadian shipbuilding industry has a real chance to continue on its own merits.

"In conclusion, in our opinion the present situation of the shipbuilding industry is such that, provided the difficulty of exchange which, after all, is an abnormal one due to the war, can be overcome by means of assistance from the Government or otherwise, there is every reason to believe that shipbuilding in Canada can continue as a profitable commercial business."

The Canadian Government Fleet

Our Canadian Government fleet has extended its activities during the year until now it is on every route in the British empire. Vessels are sailing from Halifax and St. John, N.B., in the winter, and Montreal and Quebec in the summer to Newfoundland, Liverpool, European Continental ports, British West Indies, and South America, while they are sailing to the East Indies and China from both the East and West coasts. The vessels are a fine type of ship, well found, with good accommodation for officers and crew, and in the later ships extra accommodation has been provided for three or four passengers. On the ships in the Australian service refrigerating space will be provided, as well as the domestic refrigeration that is fitted in most of them. The writer, who spent a good many years at sea, has never seen ships with such comfortable crew accommodation as these Canadian vessels, and it is a credit to their designers. The fleet, as we have had occasion to mention on several occasions, is managed exactly in the manner of a privately owned line, and on that account has managed to show a very good profit so far. The action of the management in linking up their fleet with such firms as the Cunard Line, and Alfred Holt's, have shown a foresightedness and absence of the usual bureaucratic spirit associated with Government undertakings that gives the fleet a hope of success in the lean time to come. Canada has received a wonderful advertisement in all parts of the world through this excellent fleet, and it would have been well worth while from that viewpoint alone. Apart from this the fleet has opened up trade routes for Canada, and we believe has opened up the possibilities of export trade to many who had not previously given it a thought. The fleet is pretty nearly completely manned by Canadians, and is about as thoroughly Canadian an institution as can be found in the country.

The not inconsiderable lake and river traffic carried on by the Canadian Lake transportation companies has been bigger than ever this year, and it is pleasing to note that a purely lake steamer was launched for a Canadian company from the yard at Midland during the early part of December. This is a business which Canadian lake yards are as well able to handle as any others, and they should find much profitable work of this kind in the future. The repair business is well catered for in Canada, with dry docks at Sydney, Halifax, on the St. Lawrence, at Port Arthur, Collingwood and Midland on the Great Lakes, and in the near future on the Canadian Pacific coast.

Engineering Development

It is interesting to look over the development that has taken place during the year in the engine equipment of the new vessels built. While not wishing to take the attitude of "I told you so," it is pleasing to note that the prophecy we made as to the adoption of the oil engine is coming true. There is a gradually increasing number of shipowners adopting this type of motor, and it is not in small ships by any means that it is being adopted. It is pleasing to note in this connection that the large engineering firms in Great Britain are keeping well ahead in the internal combustion engine field, and have produced several interesting designs which have proved very successful. The companies which have adopted the internal combustion engine for their ships include such well-known names as Elder, Dempster & Co., T. & J. Brocklebank and the Glen Line of Glasgow. The number of vessels fitted with internal combustion engines now represents near 2% of the number in Lloyd's Register. Those burning oil fuel under boilers number 16.3%, while 76% use coal. The remainder are sailing vessels. There is little likelihood of the spread of the use of oil fuel to raise steam, as the price of oil is getting prohibitive for that purpose. It is not in the interests of conservation that oil should be largely used in this manner, as there is a large loss attending it. A good many vessels are fitted to burn either oil or coal under their boilers, and can change over from one to the other with little trouble, thus enabling them either to oil or coal their bunkers whichever is handiest, or cheapest.

The Geared Turbine in Favor

The geared turbine is also meeting with a large measure of favor, no less than 245 vessels of 1,286,046 tons being fitted with this class of machinery during the year. The reciprocating engine is still being put in a large number of ships, and there is no doubt that it will be in use for many years yet. Its record of reliability is something that will make many people cling to it till the newer forms have something of a record to show that can compare with the old three-legged job. The United States has experimented with ships fitted with the turbo-electric drive and have been sufficiently pleased with the results to decide on equipping a number of ships with this class of drive. It does not seem to have met with any favor in England or on the Continent. There seems to be a doubt if the extra weight and expense together with the complicated wiring, are justified in the ordinary cargo vessel.

There are, of course, certain advantages associated with the electric drive, notably in manoeuvring and in variable speeds, but for a cargo vessel these do not amount to much. The oil engine has developed to a point where it can be handled in manoeuvring as smartly as the triple expansion reciprocating, and nothing could be much handier than that. We do not anticipate the adoption of the electric drive in other countries than the United States.

There would seem to be little doubt but that shipping is in for a period of low

Bringing

EVERY SEASON many steamers became later and later in arriving in port as the summer advanced owing to the heavy deposit formed on the boiler tubes.

FOR INSTANCE A large inland passenger boat calling tri-weekly at the Port of Montreal, last season, was so affected that by the middle of October she was arriving from three to four hours late each trip. Then a complete change took place, and inside of ten days she was arriving promptly on time.

WHAT CAUSED THIS CHANGE: The removal of the deposit from the boiler tubes by

Miller's Boiler-Cleaning Extract

EXAMINATION OF BOILERS: When these boilers were "let down," a thorough examination was made by an expert to see if any damage had been caused to the Boiler Tubes, Plates, Joints, Packing or Brasses, and it was found that there was absolutely NO DAMAGE. The same company used our Extract on many of their steamers with the same results.

REMOVAL OF SCALE: Miller's Boiler Cleaning Extract will remove any and all scale formed in any steam boiler regardless of the source of the water supply.

PREVENTION: Our EXTRACT will prevent the formation of any SCALE and keep the metal perfectly clean in any kind of a steam boiler using any kind of water.

No Testing of Water Necessary

This Extract Is Manufactured Only By

THE R. C. MILLER

38-40 Youville Square

A talk on special cases will appear in succeeding issues.

Steamers into Port ON TIME

Engineers are held responsible in many cases for steamers not arriving on time when the delay was caused by a blow-out of a steam joint, or other trouble with steam, arising from the use of inferior Packings.

All Steamboat Officials understand the importance of boats arriving on time, and this can be accomplished much easier if the proper materials are used for packing the Boilers, Engines, Pumps, Steampipes, etc.

False Economy: The Packing used in steam plants is subjected to the same heat as the metal with which it is surrounded and is also subjected to the great pressure of the steam, and as the extreme heat drys the Packing it cannot withstand the pressure of the steam behind it and give efficiency unless the best quality is used. Would it not, therefore, be **false economy** to buy a low grade Packing to be used for such important work?

Genuine Economy is only obtained by using material that will **"stand up"** or give the greatest amount of efficiency in all cases. This applies to all kinds of goods, but most particularly to the use of Packings in a steam plant where so much depends on its **"standing up"** to the work.

Markets of the World: Our aim is to be able to supply to the users of Packings in Canada the best that is manufactured in any part of the world, as we believe that nothing is gained and a great deal is lost by using inferior goods.

Our Packing Department has been highly successful in securing what is universally considered to be the most reliable and efficient Packings in existence for each individual kind of work.

Our Clientele: We are privileged to be able to say that we have among our customers some of the most important institutions in this country, and we feel satisfied that their number will be added to continually as we save no expense or pains to secure the goods to give efficiency in all cases, no matter how severe the test may be.

High Grade Lubricating Oils and Greases, Soaps and Metal Polishes

OIL & SUPPLY CO.

Montreal, Canada

A talk on "Special Packings" will appear in succeeding issues.

freights and hard times, and this will continue till the world settles down, if such a desirable consummation ever takes place. In circumstances like these, the only chance of survival is by practising the very bed rock of economy in the running of ships.

This means keeping personnel down to the minimum, quick turn round in every port, and the minimum of lost time for any cause. We believe the ship with oil engines will be far ahead of any of her rivals in this matter, but the number of them at present is so small that their effect on the general situation is small.

However they are increasing in a very steady manner, and in the next ten years it would not be a matter of surprise to see the major portion of the carrying fleet fitted in this manner. The next twelve months should bring some interesting developments in connection with the United States merchant fleet, which must be put on a commercial basis or go out of business. Just what method will be finally adopted to keep it afloat is hard to say, but we venture the opinion that enforcing the provisions of the Jones Act will do more harm to the new fleet than anything else that could be done.

The trouble is that the U. S. ship is costly to run, more so than any other nation ships, and there is no politician in the States with nerve enough to try and repeal the LaFollette Act. Even if there were, and he were successful, it is questionable if the ships could be manned with the special inducements removed. As it is, sailoring in United States ships is so desirable that numbers of men desert in U.S. ports from other country ships to get in on the good thing. There is no reason in the world why the United States should not have a merchant fleet, if sufficient people are interested in it, but to try and create a merchant fleet by eliminating the ships of all other nations from their ports, is to say the least a mistaken idea. The practice of withdrawing tonnage for a time, and then throwing it on the market in an effort to wipe out competition has also resulted in wiping out American companies which was not quite within the intention of the gentlemen who were doing the manipulating.

France has been handicapped in her shipping activities to a great extent by the coal strike in England. A large number of the French vessels were of the small collier type, expressly for carrying coal from South Wales to French ports. Naturally they have not been able to do much in this line. The large French transatlantic line is well under way again, after the cessation of the war. Italy has added considerably to her fleet, and has resumed all the services which she used to carry on. The Italians are experienced shipowners, and were possessed of some fine vessels before the war, and were among the heavy sufferers by the war. Japan has considerably increased her tonnage, but things are not too rosy in shipping circles in Nippon just now. Germany and Austria are of course still out of the reckoning as far as merchant shipping is concerned, although the arrangement made with the company of which Mr. Harriman is in control, points to the fact that the Hamburg-American line is not going to frozen out if they can help it.

This is not a time for prophesying, but more for hoping, and the hope is that the turmoil in Russia and other European countries will subside ere long and active trading commence between the various parts of the world. Only in that way will there be cargoes for the ships of all nations, work for the people of all nations, and an equitable exchange rate which will once more put commodities in the reach of people of moderate means. In short, a return to the normal is what we hope, but with a higher standard of living than obtained before the war. This is quite within reach, once the peoples of the different countries settle down to working instead of fighting. Let it be soon.

LAUNCHING A CANADIAN GOVERNMENT STEAMER AT COLLINGWOOD—THE "CANADIAN ROVER."

REDUCING CORROSION

According to D. M. Buck, metallurgical engineer for the American Sheet & Tin Plate Co., Pittsburgh, there is an overwhelming mass of evidence to prove that by allowing with normal open-hearth or Bessemer steel a small copper content—0.15 to 0.25 per cent.—the corrosion produced by air and moisture is greatly reduced. The melting point of copper is about 700 deg. Fah. lower than the average tapping temperature, it diffuses readily, and once diffused does not segregate.

The manufacture of copper steel has heretofore been largely confined to sheet metal, and the product has been greatly improved. A conservative estimate indicates that the life of sheet metal is at least doubled by this treatment, and in speaking of this subject he advocated the use of copper in all iron and steel products called upon to resist the attack of air and moisture.

It was stated at a symposium on refractories for electric furnaces held by the Electric Furnace Association, of Columbus, U. S. A., that refining furnaces, handling metal and corrosive slag at temperatures limited only by the melting point of the furnace itself, have about reached the limit of their possible development. It would appear that a new, cheap, dependable refractory with a melting point higher than 1750 deg. Cent. is now required, a substance which is highly resistant to sudden temperature variation so as to permit intermittent operation, which has been calcined at electric furnace temperature, and which, therefore, possesses reasonable constancy of volume. It must resist the scour of slag—or if a roof brick, must withstand the action of fume, hot gases, and splatters of liquid. It must be a poor conductor of electricity, or leakage of current may be serious. Finally, it must have sufficient strength at high temperatures to meet the requirements for the arches and side walls of the furnace.

A proposal is being considered, says the Engineer, to preserve the French supply of gun-cotton and nitrocellulose explosives — about 90,000 tons — by placing it in tanks at the bottom of a lake in the Pyrenees. Stored away at a safe and constant temperature, it is believed that the material would neither deteriorate nor decompose.

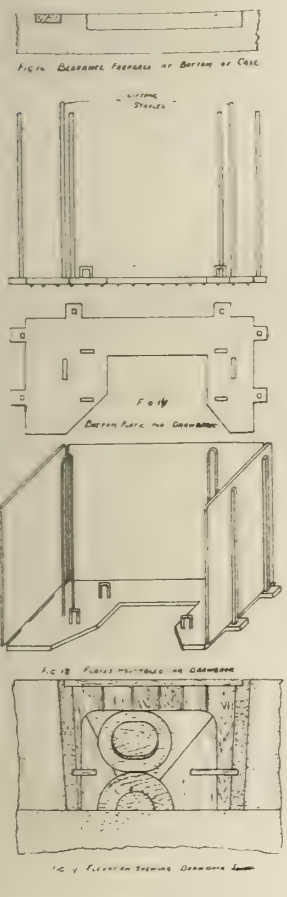
The Molding and Casting of Condenser Parts

Showing Method of Molding the Patterns Described in Former Issues of This Publication, Being Condenser for Modern Steam-Ship Engine.

By BEN. SHAW and JAMES EDGAR

THE making of the main core box can, however, be avoided by what is known as thicknessing in the mold and forming the core inside. The method has the advantage of giving a more regular thickness of metal to an irregular shaped casting, and can be applied to a condenser of this type. From an economical point of view, the casting can be made cheaper when only one or two are required, but more time is occupied in the preparation of the mold for casting, since the same number of men employed in the method previously described cannot conveniently work when the core is made in the mold.

The type of case which is suitable for taking such a job vertically is illustrated in Fig. 13. It consists of four



sides bolted together, let into a bottom having an external flange, which can be sealed and made watertight by ramming sal ammoniac and iron filings between the box sides and the bottom flange. The best type has tapered sides, so that the withdrawal of castings is not restricted. A stiff top flange is cast about the top, having a number of slot holes cast through as shown. A level bed is prepared at a depth from the top of the case, equal to the height of the condenser body, and the pattern is lowered to get an impression of the prints. It is better if these prints are dowelled on, as when their position has been located they can be bedded in separately, as shown in Fig. 14, and the pattern replaced upon them—Fig. 20. The bottom flanges can be loosened and simply laid on the bed, and against the body of the pattern, and a commencement made with the ramming up of the sand, the screws being removed from sections of pattern as the ramming proceeds. It is necessary to rod the sand directly over the bottom flange, and over the horizontal ribs which surround the pattern. The sand can be rammed up in this way the full height of the job, and almost all round the pattern, the exception being the branch. A joint is required to allow for the withdrawal of the pattern and to enable the core being placed. It is better to level off the sand at the height of the branch centre over the full end of the case, and taper off the side joints as shown in Figs. 15 and 19. This enables the drawback being made with the minimum contact with the mold. The type of carrying plate for such a drawback is shown in Fig. 16, having staples cast in for lifting, and also wrought iron rods cast in snugs

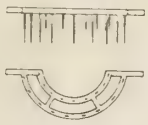
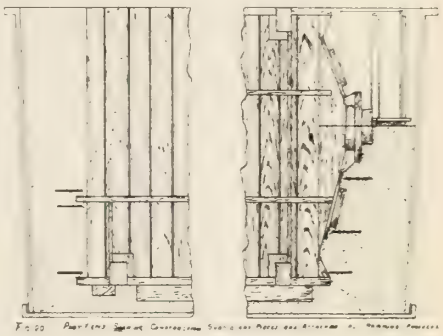


FIG. 17.

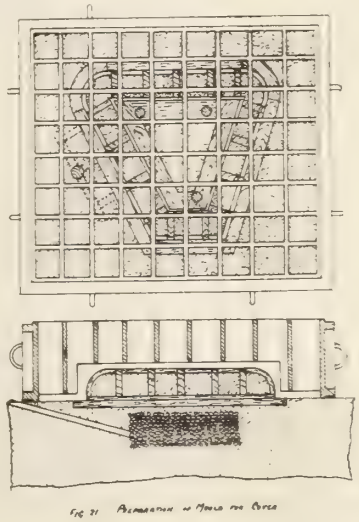
for supporting side plates, as shown in Fig. 18. The back and side plates shown make the drawback independent of the mold excepting at the face and bottom.

To carry the sand over the branch flange an additional grid, shown in Fig. 17, is secured to the bottom plate. In commencing the drawback, a bed of loam is applied to the joint, and the bottom plate set into it. Loam is also applied to the tapered joints at each side to maintain a parting and prevent injury with the rammer. When the side plates are fixed up against their supports the drawback can be rammed up, a small riser being introduced from the bottom of the flange. Small projecting parts of the rib, cutting through into the drawback require to be cut for convenience in drawing. The cope in this instance is flat, and provision is made for pouring the metal directly into the mold. When the cover box and the drawback have been removed the body of the pattern can be withdrawn, the subsidiary parts remaining until the core is made. Strips of wood, equal in thickness to the metal required, are temporarily attached to the flanges and ribs and running the depth of the mold, the drawback is replaced, leaving the branch pattern in the mold. Ordinary floor sand is used to fill up the space between the strips and the



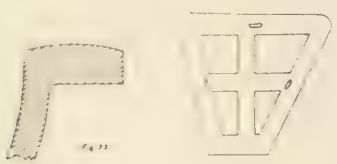
main print is withdrawn. The whole then provides the core box in which a satisfactory core can be made. Besides the lifting plate at the bottom, a couple of ring plates should be used to strengthen the loam and bricks as the distance from the bottom increases. The centre of the core is left open until the mold is fitted together for casting, when it is lightly rammed with floor sand and when the drawback is finally placed in position the intervening space between it and the case is also filled with sand and rammed.

In preparing the mold for the cover the method adopted depends largely upon the style of box available. As a rule, when it is possible the flange is cast down, the pattern being bedded into the foundry floor until the uppermost part is flush with the floor level or merely bedding the flange into the floor as



indicated in Fig. 21. When prepared in this way for casting, a bed of ashes must be formed under the job to allow for ease in venting. The skeleton construction of the pattern allows the ramming of the core to be done quite satisfactorily, the sand being carried to the outside of the pattern and strickled off. After the cope has been rammed, making suitable allowance for runners and risers, and removed, the surplus sand making up the pattern can be strickled out and the pattern wthdrawn.

The core carried in the drag requires to be well sleeked over, the sharp corners of sand removed at each side of the ribs to form a fillet, then the ribs can be withdrawn and the facings drawn into the impression. A reasonable amount of care must be exercised in the withdrawal of these ribs and the facings since the bottom is not accessible for patching. Some molders prefer to cast the flanges uppermost, bedding the pattern into the floor until the top of the flange is flush with the floor level. This method necessitates a considerable lift in the cope, a grid usually being fixed to the cope box to carry it. Dirty metal has a tendency to collect on the face of the flange when the casting is poured in this way, and since it is to be machined the difficulty is overcome considerably by shaping the flange as indicated in Fig. 22.

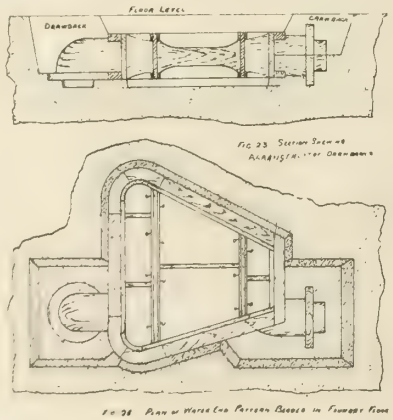


FIGS. 22 AND 24.

The making of the mold for the water end is a much more difficult job. When the pattern for the main part is made similar to the required casting, the method described in this article, the method of constructing the top and bottom flanges usually decides the molder on his choice. When both flanges are framed and used as a support to the shell pattern, obviously they cannot be drawn into the mold, hence a joint must be made at both flanges and the middle part either lifted in a box or taken away as a drawback. Even if the bottom flange is cut in such a manner as will allow for drawing in, the method can still be adopted. The core would then be left in the drag. While this method is used it entails more work in providing a suitable mold, since a special large plate is required to carry the drawback or a special type of box part must be used, and grids are equally essential to strengthen the core as it is divided into so many parts by the division plates and ribs. When the pattern work forming the bottom flange is in convenient sections, an alternative method of producing the mold can be adopted, and, since less tackle is involved, resulting in a more profitable casting, more consideration is given to the procedure adopted.

When the foundry floor is used, as is usual in such instances, a shallow pit is required having a depth which will allow a reasonable body of sand over the inlet and outlet branches.

The bed should be levelled off to allow the bottom flange to rest flat upon it. This necessitates the core print of one of the branches being bedded in. The division plates and ribs are temporarily removed from the pattern to allow a print being formed to conform to the internal contour and having a depth of at least 2 inches, as shown in Fig. 23. The cope remaining stationary, apart from drawbacks over the branches, the core must of necessity be made loose and since it is not desirable that it should be divided into as many pieces as are indicated by the ribs, the print is made deep enough to take a lifting plate over the whole area and strong enough to support the whole as one core. When the print has been cut out, loam is applied to the bottom and a plate, shown in Fig. 24, bedded in. The ribs and division plates can be returned to their former position and small grids inserted when the ramming up of the core can be proceeded with. All loose parts fastened from the inside must of course be detached as the work is proceeding. The outer part of the mold can also be rammed up, forming joints about the back of the flange on one branch and along the horizontal centre of the other branch, tapering them up to the floor level after forming a good bearance, in a manner shown in Figs. 23 and 25. When making the two drawbacks it is convenient to bed suitable grids in loam, and loam can be applied to the sand sides with advantage, because careless ramming sometimes injures these sides and interferes with the lift. The core will follow the lines of the ribs, the remainder being taken away in the cover box including the loose facings from the division plates. A casting of this description can be run successfully straight down by the side of the main core, taking care to clear the cores of the branches, and greater satisfaction will be obtained if the impression of the top flange is curved as in Fig. 22.



When stripping has been commenced and the cover removed, the centre core can be withdrawn. If a little taper has been allowed on the pattern it should not be a difficult job. The top flange can be left on the pattern to give support to the shell, which can then be withdrawn. When the drawbacks are lifted the final stripping can be made and the mold sleeked up. The molds for both the cover and the water end are more satisfactorily made in dry sand, hence both molds require to be dried and blackened for receiving the metal. With the exception of the cover for the water end, which should be at least skin dried, the remainder of the small casting necessary to complete the job can be made in green sand. They are, however, comparatively simple and do not need description here.

Unique Order.—Eleven vessels, ranging in size from gas boats to big stern wheelers over 200 feet in length, with a total value of well over $200,000, will be built in Vancouver for the Hudson's Bay Company for operation on the Mackenzie River during the coming spring and summer months, according to information given by an official of the company who is making arrangements for the commencement of the work.

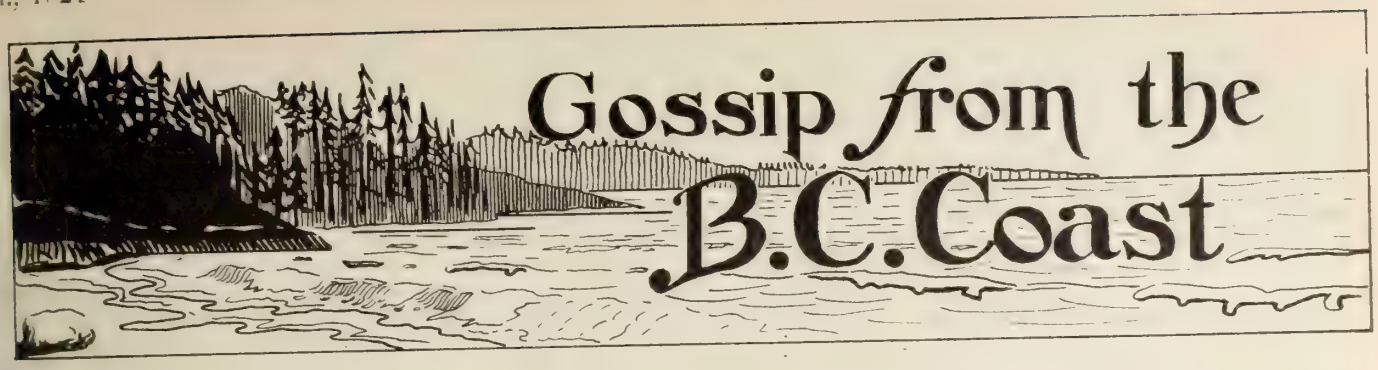
We have received a catalogue from the Hanna Engineering Works, Chicago, Ill., describing their riveting machines, of which they manufacture a very complete line. The catalogue illustrates riveters for every kind of work, from those fitted for automotive work to those made for boiler and shipbuilding work. The motion of the special toggle joint in the machine is clearly explained, and line drawings are given which make it quite clear. Some useful tables are included, notably one on the tonnage for rivets of different sizes.

QUESTIONS AND ANSWERS

Question.—Please inform me what size stack I will require for tugboat with switch boiler, three furnaces 3¼ by 7 feet 4 inches. Also what anchors and chains to suit Lloyd's requirements for boat 120 feet by 25 feet beam.

Answer.—The diameter of funnel will be in proportion to the grate area. You have three furnaces each $3.25 \times 7.4 = 24$ square feet, which gives $24 \times 3 = 72$ square feet total grate area. The funnel area should be about 1-6 of this, which would be 3.46, say 3½ feet. The height would depend on the draught you require, and for soft coal with natural draught ¼ inch water column should be all right. A height of 40 feet from the grate level would be suitable, but you may have to make it shorter on account of other conditions.

You will require three anchors: One bower 6½ cwt., one 6 cwt. and one kedge 2½ cwt. Chain required is 90 fathoms of one inch, if stud link to weigh 45 cwt. 3 quarters 17 pounds, and open link to weigh 49 cwt. 2 quarters. You will require 60 fathoms 6 inch hawser and 60 fathoms 4½ inch warp, or their equivalent in steel wire.



MARKING the last stage in the negotiations for the construction of the Federal Government drydock at Esquimalt, it has been announced that the contract for the job has been awarded to Peter Lyall & Sons, of Montreal and other Canadian cities, whose tender was for $4,300,000, or about $200,000 less than the Government's estimate.

* * *

Representatives of the Lyall Company are expected to reach Victoria to make preliminary plans for the big job in the immediate future, and actual work will probably get under way in February. The Esquimalt drydock will be one of the largest in the world and will have accommodation for the biggest vessels afloat. Three liners may be accommodated at once when the project is completed according to the plans agreed upon. The dock is to be excavated out of solid rock, and the walls will be built of concrete with granite copings.

* * *

Officials of the Dollar Steamship Company have decided to divide the freight fleet into separate units. According to the new arrangement, the M. S. Dollar, Esther Dollar and Grace Dollar will load at New York and sail via the Panama Canal to San Francisco, then to Shanghai, Hongkong, Manila, Singapore, Calcutta and probably Colombo, and then via the Suez Canal back to New York. The steamers Melville Dollar, Bessie Dollar and Harold Dollar will load at New York and travel via the Panama Canal to Vancouver and Victoria, thence to Shanghai and Hongkong and then return via the same route.

* * *

The auxiliary schooner Laurel Whalen has been purchased from French interests by the British Columbia Cement Company and will be used as a depot ship for the company's two plants at Saanich Inlet and Bamberton.

* * *

An office will shortly be established in Vancouver to take care of the joint interests of the Royal Mail Packet and the Holland-Amerika lines. The Royal Mail Packet and the Holland-Amerika will operate a freight service between British Columbia ports and New York, Southampton, Cherbourg and Hamburg.

* * *

Reports that Seattle was to be eliminated as a port for vessels of the Nippon Yusen Kaisha in favor of Vancouver have been denied. In fact, the company proposes to increase its number of sailings and will shortly add a number of new vessels to the service. Most of the freighters will pass Victoria for Vancouver and Seattle, it is stated, although the passenger boats will stop at Victoria and eliminate Vancouver. The Tokushima Maru, Durban Maru, Dakar Maru and later the Delgoa Maru are among the new additions to the trans-Pacific route.

* * *

Keels for the two new Federal Government steel steamers, the Canadian Transporter and the Canadian Trader, have been laid at the yards of J. Coughlan & Sons, Vancouver. The company now has about 700 men on its payroll.

* * *

In order to meet competitive rates being charged by foreign steamship lines, the United States Shipping Board has reduced rates on wheat and flour from Pacific Northwest ports to the United Kingdom, Bordeaux and Hamburg from $18 to $16 a ton.

* * *

The Cholberg Shipyard has discontinued work on its wooden schooner hulls with the exception of the S. F. Tolmie, now nearing completion. It is reported that the company wants to have the Tolmie actually chartered before proceeding with the construction of the other craft, and about sixty per cent. of the shipyard workers have been released.

* * *

Statistics compiled by the Pacific Steamship Company's experts show that the present year will be marked by a jump of $523,565 in the fuel oil bill for the company's coastwise vessels. This is only one of the increases in cost of operation that the company will have to contend with this year. The company is placed in an awkward position by reason of the fact that its rates are largely governed by those of the railroads, which are in close competition. The Pacific Steamship Company is unable to independently pass the increased cost on to the public without driving thousands of dollars' worth of business to the railways. Most of the company's coastwise vessels were built for burning oil and could not conveniently be converted into coal-consumers. Even if they were converted, the coal would take up so much room that little space would be left for cargo accommodation.

* * *

Pacific shipping and foreign trade circles were surprised by the announcement that the famous Japanese firm of Suzuki & Company has increased its capital from $250,000 to $25,000,000. The Suzuki assets amount to $250,000,000 and its small capitalization was a novelty often wondered at. Madame Suzuki owns the company, which controls steamship lines, manufacturing plants, steel mills, agricultural enterprises and other interests.

* * *

Despite the depression in the shipping business on the Pacific, especially as it affects Japanese shipping, the Nippon Yusen Kaisha has declared a dividend of 30 per cent. for the year. "The N.Y.K. is in a stronger position than ever and ranks among the best established shipping companies in the world," declared Baron Rempei Kondo, president of the company, in addressing the annual shareholders' meeting recently.

* * *

During a six-month period, including last summer and the fall of 1920, a total of 8,783 passengers were carried across the Pacific, according to figures just compiled, which give the standing of the various companies as follows: Canadian Pacific Ocean Services, 2,892 passengers; Toyo Kisen Kaisha, 2,700; Nippon Yusen Kaisha, 1,400; Osaka Shoshen Kaisha, 1,200; China Mail Steamship Company, 900; Pacific Mail Steamship Company, 690. Japanese vessels carried 4,300 first-class passengers; British, 2,893; American, 1,590. Sixty-four per cent. of these passengers were American; 17 per cent. British, French, Dutch and Russian; 7 per cent. Japanese and 12 per cent. Chinese.

* * *

The tanker Atlas, which ran aground in Snow Pass late in December, will be repaired by Yarrows, Ltd., Esquimalt. The vessel belongs to the Standard Oil Company of California. She was temporarily repaired at Ketchikan and Prince Rupert and when she arrived in Seattle bids for permanent repair work were called for. The Canadian plant outbid all others and secured the job, which will require about a week to complete.

The Luckenbach Steamship Lines will shortly inaugurate a semi-monthly service between Puget Sound and the East Indies, and may include British Columbia ports in the sailing schedules. The Julia Luckenbach will be the first to enter the new service and has already left the Atlantic seaboard. She is a 13,000-deadweight-ton freighter. She will be followed by the Edward Luckenbach, Walter A. Luckenbach and the F. L. Luckenbach, sister ships, according to Captain H. H. Birkholm, Northwest manager of the General Steamships Corporation, Seattle, agents for the Luckenbach interests.

* * *

Captain T. P. O'Kelly, assistant chief commissioner of the Hudson's Bay Company, is negotiating with British Columbia shipyards for the building of two stern wheel steamers which his company proposes to operate on the Mackenzie and Peace Rivers. It is intended to send the boats knock-down into the north and to rebuild them there. To increase its transportation facilities on the northern rivers the company will dismantle the steamship Fort Simpson, now operating on the Skeena River, for shipment to the Mackenzie River.

* * *

The little steamship Dora, known as "the bulldog of the North Pacific," ran aground on Noble Island between Vancouver Island and the British Columbia mainland December 20 and a few hours later foundered in forty-five feet of water. According to reports, the vessel was backed off the island where she first struck, but when it became known that the hull was leaking badly she was beached on Vancouver Island, opposite where she struck. The Dora was formerly owned by the Alaska Steamship Company, but at the time of the wreck was owned by the Behring Sea Fisheries Company and was on her way from Seattle to Unga. The crew was saved.

* * *

Reports reaching here recently indicate that the headquarters of the Union Steamship Company, which operated the Canadian-Australian Royal Mail line between Australia and New Zealand and British Columbia ports, may be transferred to the Union Steamship Co., for £1,500,000 cash and £500,000 in shares. Ever since the effects of the new control have been felt high union wages and continual strikes have influenced the management in its reported intention to move from Auckland to London. The cost of operating out of New Zealand is said to be 25 per cent. more expensive than out of London on the present service.

* * *

The Canadian Pacific Railway has completed negotiations with the Canadian Collieries (Dunsmuir), Ltd., of Victoria and Nanaimo, for the supplying of up to 25,000 tons of coal a month to steamers operated by the C.P.R. in the British Columbia coast and trans-Pacific services.

* * *

Most of the vessels will coal at Union Bay, while a few will use the bunkers at Ladysmith. There will be no change in the bunkering arrangements, according to General Manager J. M. Savage of the coal company.

* * *

The contract for the 25,000 tons of coal a month is one of the largest to be consummated on Vancouver Island for some time. Outside of the C.P.R. contract, however, the coal movement is said to be rather slack, owing to mild weather conditions.

* * *

It is stated that the output of the Canadian Collieries, as a result of the new contract, will be increased about 25 per cent. by the output based on 1919 figures, or about one-fifth as much again as the total production of the island collieries in 1919.

* * *

The contract for the repair of the Grand Trunk Pacific steamship Prince Rupert, which ran aground in Swanson Bay in September, has been awarded to Yarrows, Ltd., Esquimalt, whose bid was considerably less than that of other tenderers. The Yarrows' bid was $258,000; Wallace Shipyards, $298,000; Coughland, $364,000, and B.C. Marine Ways, $379,000. The damaged vessel is already in Esquimalt and the repair job will take about 115 days to complete.

News from Port of Sorel

THANKS to the local steamship inspector, Mr. F. X. Hamelin, for the district of Sorel, Que., I am able to give our readers a very interesting account of the many boats now in the port of Sorel. This I have been trying to compile for a long time, but I have at last been successful.

* * *

Not counting the several sail boats, such as "pins" and canal boats, schooners, etc., there are 78 steam vessels of all sizes and descriptions worth many millions of dollars. The list is published here for the information of shippers, marine engineers, steamship inspectors and all people connected with Canadian navigation.

* * *

S.S. Argenteuil, Aranmore (Messrs. T. McConkey and E. A. Hopper of the Board of Steamship Inspection, Ottawa, after a survey of this boat, have decided that she must undergo general repairs).

* * *

S.S. Andree D., B. Paul, Contrecoeur, Chambly, Carmelia, Conqueror (this boat was formerly an American vessel, the W. L. Proctor).

* * *

Cape Eternity (formerly Rochester, a U.S. boat), Cape Trinity (formerly Syracuse), Cape Diamond (formerly Murray Bay).

* * *

C. W. Chamberlain (this vessel, official register number 80574, owned by James Swift, Kingston, Ont., has now been purchased by the Sincennes McNaughton Line after she had been damaged by fire. The Sincennes McNaughton people will repair her for the coal trade between Oswego and Montreal).

* * *

Detector (in the Federal Government Hydrographic Service), Deschaillons, Dougaldmac (formerly the Columbia, an American vessel, now registered as British, machinery taken out, will now be a coal barge).

Emilia, Ethel, Emma L., Frontenac, Fredmac, F. Paul, Francois C. (this boat formerly owned by Messrs. J. B. T. Lafreniere, J. A. Simard and Alcime Beaudet, has been sold to Alcime Beaudet, who remains the sole owner. The repairs and changes to this vessel which were mentioned in our last issue are in progress. The engine and boilers will also be overhauled).

* * *

Hudson (the owners, Sincennes-McNaughton Line, are making extensive repairs to her engine and boilers).

* * *

Iberville, James Howden, Jesse Hume (it is understood that J. W. O'Brien, assistant superintendent of Railways and Canals Department, will probably choose one of these three to replace the Sir Wilfrid which was lost by fire, until the Government has another tug rebuilt).

* * *

Jeannette R., John Pratt (this vessel is on the ways of the Sincennes-McNaughton Line's shipyard and will undergo extensive repairs to her tail shaft, propeller and rudder).

* * *

Joffre D., Lothbiniere, Lac St. Pierre, Lanoraie, L. Paul, and Marine and Fisheries Department's dredges 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14 and 15. It will be noted that No. 9 is left out. After being remodelled at Levis, she was sold to a French company who are using her in Europe as a freighter.

* * *

Macsin, Muscallonge, Macsinco, Myra, Mathilda (repairs to boilers, replacing defective plates, etc.), Montreal, Maisonneuve (this vessel is on the ways at Manseau's shipyard, where she is being remodelled, widened, etc., to give her more stability).

* * *

Nathalie R., Pierrepont, Prince Louis, Prince Ray, Quebec, Rosalie L., Rapids Prince, Rapids Queen, Rapids King, Reliance (this freight barge, formerly owned by Adolf Lomer and now by E. A. D.

Morgan, is a twin screw boat 120x23x9 with a gross tonnage of 239.14 and is for sale).

* * *

Richelieu (this barge, the property of Mrs. Rosanna Boucher, of Sorel, is being widened 4½ feet each side so she can carry more cargo on the main deck. Also she is being fitted up with a parlor and fitted to carry more automobiles. She is used as ferry between Verdun and La Tortue).

* * *

Ralph T. Holcomb (this vessel, owned by the Edwardsburg Starch Co., has been surveyed by the inspectors, who have decided she must be rebuilt from the bilges to the top; in doing so, her holds will be raised three feet and she will carry that much more cargo when completed.)

* * *

Spray, Sinmaco, Sinmac, Saguenay, Trois-Rivieres, Terrebonne, Wm. McRea (it is understood that she will be rebuilt, but although this tug is on the ways at Manseau's shipyard, the work has not been begun).

* * *

Virginia, Yvon (this boat having suffered heavy damages and having been considered too expensive to repair, has been dismantled and the engine and boiler were taken out and the hull scrapped).

* * *

Shamrock, Vercheres and Reserve (repairs on these last two boats begun).

* * *

Final contracts between the City of Sorel, the Quebec, Montreal & Southern Railway Co. and J. H. Dansereau, in connection with the pulp mill which is to be established at Sorel, Que., have been signed at Montreal on January 15, 1921.

* * *

Work at the concrete wharf will be started as soon as possible, and it is a part of the agreement that the pulp industry people will spend at least $500,000 between this and May, 1922, and it is understood that this amount will be exceeded by probably $200,000. Mr. Dansereau is leaving for Europe in a few days. In the meantime, the wharf will be begun and on his return other contracts will be awarded. Plans and specifications are being made now. The land survey is completed. At least forty tons per day will be the initial capacity of this pulp mill.

* * *

All the work in connection with the building and installation of equipment of the Co-operative Waterproof Garment Co., of Sorel, is now finished and the works are in full operation. There will be some future extensions to the buildings, probably in the course of the year.

* * *

The sale of the plates, carpets, furniture, etc., of S.S. Northland, which was conducted by the Sorel Mechanical Shops, has brought good returns. There remains to be sold two 3,000 H.P. triple expansion engines and ten boilers 12 feet 3 inches by 11 feet 6 inches with a working pressure of 200 pounds. The Sorel steamship inspector, F. X. Hamelin, has the details of construction covering these.

* * *

Three boats belonging to the Sincennes-McNaughton Line will be changed from coal to fuel oil burning during the course of this winter. They are the Andree D., the Fredmac and the Virginia, which have Scotch marine boilers, and the experts who have been called in to make a survey of the same have decided to change as above.

LAUNCH AT MIDDLESBROUGH.

On Thursday, 23rd December, 1920, Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, the steamer "P.L.M. 23," the fourth of eight similar vessels which they are constructing for La Compagnie des Chemins de Fer de Paris a Lyon et a la Mediterranee, whose shipping business is managed by their subsidiary Company, La Societe Nationale d'Affretements.

The vessel is being built to a very high class specification and has been designed specially to fulfil the requirements of the owners' particular trade, her principal dimensions being 400x56x 31 moulded with a deadweight carrying capacity of about 8,900 tons on a light draught of water, and is being built under special survey to receive Lloyd's highest classification also to meet the requirements of French law.

The steamer is a single deck vessel of the builders' well-known cantilever framed type which has proved so successful for the coal and other bulk cargo trades. This system of construction renders the ship a complete self-trimmer and gives the steamer greatly increased water-ballast capacity, which in this ship will be about 3,500 tons, enabling the vessel to make satisfactory voyages under light conditions.

Captain's accommodation will be provided in a large house on lower bridge with wireless room and chart house on top. Saloon and officers' accommodation will be located in house on bridge deck amidships, while engineers and petty officers accomodation will be found in houses on poop deck at casing sides. Crew will be berthed in poop tween decks.

The vessel has 4 large self-trimming holds, which are absolutely clear of any beams, pillars, or other obstructions whatever, and cross bunker The 7 large hatches are to be fitted with Hogg-Carr patent hinged steel covers, and the steamer will have 2 masts, at each of which will be fitted 2 Cyclops winches and 2 derricks for raising and lowering these hatch covers, everything being specially designed with a view to the vessel being loaded and discharged by means of grabs.

Wireless apparatus will be installed and the ship will have 2 life-boats with Welin's davits, 2 dinghies, electric light throughout, also electric bell installation with fans in cabins, electric whistle, Morse lamp and semaphore. There will also be a heavy steam warping winch aft, together with steam capstan and steam windlass by Clarke, Chapman & Co., as well as Wilson-Pirrie steering gear by Donkin & Co., with telemotor control and a special mechanical system of ventilation in crew's quarters and in engine room. All equipment is one grade above Lloyd's rules.

Water-ballast will be carried in cellular double bottom, aft peak and two large fore peak tanks as well as in top-side tanks.

Quadruple expansion engines, placed aft, having cylinders 23, 32½, 47 and 68 by 48 stroke, supplied with steam by 3 large single ended boilers working at 220 lbs. pressure, having Howden's system of forced draught, will be fitted in this vessel and three sister ships by the North Eastern Marine Eng. Co., Ltd., Wallsend-on-Tyne, while the remaining four vessels will be similarly engined by Richardsons, Westgarth & Co., Ltd., Middlesbrough.

The vessel and her machinery are being constructed under the superintendence of Monsieur Marechal and Captain Veyrat of La Societe Nationale d'Affretements and Mr. Reginald J. Eyres of Messrs. Eyres & Byrers, Newcastle-on-Tyne, Sunderland and Marseilles.

According to the "Electrical Review," London, the paper mill and sulphite factory at Vargo, Sweden, which were destroyed by fire in 1918, have been rebuilt and again set in operation. Owing to the difficulty experienced in obtaining coal the directors of the Vargo company, in connection with the work of reconstruction decided to adopt electricity throughout, including the use of electrical boilers in the steam plant, and the works now consume no coal, whereas 20.000 tons per annum would be needed under former conditions. The boiler house contains seven "electric" boilers, each of 3,000 h.p. Current is used in the boilers at 10,000 volts. Each boiler is provided with three electrodes, and the connection arrangements are such that steam generation can be regulated within 5 per cent. It is stated that full steam pressure can be raised in from five to ten minutes after switching on the current, and considerable economy in attendance is obtained as compared with coal firing.

J. W. Norcross, president of the Canada Steamships, who has been in England and Europe since October last, with the exception of one week that he spent in Montreal, is expected back about the end of February or the beginning of March, at which time it is estimated that there will be further developments to announce in connection with the Canada Steamships' part in the proposed British Empire Steel Corporation merger.

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What of the Future?

THE year 1921 commences with a general slackness of business in practically every line. There are various causes assigned for this, but there is every reason to assume that it is owing to the failure of normal markets, and the restriction of trade due to high prices and adverse exchange situations. The shipping business, and this includes the building of ships, is one of the lines to feel the present depression in its most severe form, as when freights decline ship owners are more concerned over finding means of running the ships they already possess than in building new ones. The one hopeful sign in the shipbuilding world is the oft reiterated fact that the world is not over supplied with shipping, that is, that were world conditions normal there would actually be a shortage of tonnage. In another part of this issue there is an article discussing the shipping situation as it exists throughout the world, and with special reference to Canada. In that article there is incorporated a letter from the manager of one of our leading shipbuilding firms, itself a branch of a very famous Old Country firm. This gentleman, while frankly admitting the adverse factors, contends that there is no justification for undue pessimism. He feels that if the present dull period can be bridged over there will be a legitimate field for those firms which are on a sound economical basis. He points out that as far as price is concerned, apart from the exchange factor, ships can be built in Canada at a price which will allow competition. Labor costs must come down, but that may not mean so much a reduction in wages as an increase in efficiency, and that already seems to be in evidence. We believe that those yards which combine a first-class repairing equipment, as well as a building plant should have every chance of a profitable existence, and as this applies to practically all the yards now in active operation cessation of effort should certainly not be allowed to take place.

We think that Mr. Gillam's letter is a closely reasoned and, on the whole, a cheering letter for those engaged in the shipbuilding business in Canada.

Returning To Reason

THERE are signs that labor in the shipbuilding and engineering trade in Great Britain is getting back to a normal viewpoint, although there is a considerable distance for them to go. One of the best signs lately was the decision of the federated engineering trades, after a consultation with the employers, to postpone any talk of a wage increase for a further period of six months. Under the present conditions of trade, this was about as wise a move as could be made. A further good omen is the fact that when the joiners struck lately for some fancied grievance, they received but little sympathy from the other shipbuilding trades. The unfortunate part of the joiners' strike was that ships in an advanced stage of completion were held up, and the loss due to cessation of work at such a stage is much greater than in the earlier construction period. The whole truth of the present period of cancellation of orders in the yards of Great Britain is that the attitude and actions of labor in the past two years have made the building of ships to be run at a profit in a falling freight market impossible. It has driven away a large amount of the ship repairing business from the Tyne and other centres, and it is hardly necessary to point out what a large loss is involved in this. It is not so much a question of wages in Great Britain as the difficulty in getting the men to deliver an hour's work for an hour's pay. However, the signs are that the men are at last finding out that ca' canny and continual strikes are good for neither the industry nor themselves, and in their speedy realization of this is the hope for the shipbuilding supremacy of Great Britain. There is a lesson in this that might be taken to heart by some of our own labor leaders.

IT is interesting to note that Canadian manufacturers have been developing the export field and introducing some Canadian products to other markets for the first time in some cases and re-introducing other lines which lost connections during the war. Figures of exports to the United Kingdom for 1919 show the resumption of exports of cast iron and steel pipe, unwrought copper, wrought enamelled hollowware, white lead, brooms and brushes, and binder twine, after the slackness of 1918 and previous years.

* * *

DOCTORS, dentists and other such professional vocations are the only ones to support the adoption of the metric system in Canada. Merchants and manufacturers alike are in opposition to any such scheme as would cause chaos in Canadian trade.

* * *

LESS than a year ago a man with a pile of steel sheets in his yard was sitting on them surrounded by a shotgun and an axe for fear some one buyer would insist on taking the lot. Now said buyer can come in unmolested and take the heap.

News of The Shipping World

SOME interesting opinions on the ultimate condition of the coal export trade were voiced recently by a leading South Wales coal exporter, Mr. D. R. Llewellyn, in connection with the competition that has been experienced from the United States. The occasion was the annual meeting of the Gwaun Cae Gurwen Colliery Company, of which the speaker is chairman. Mr. Llewellyn's remarks as to the coal trade might, we think, be very well applied to other trades, including the iron and steel. There is no doubt that during the last few months there has existed a state in all trades that is more or less artificial, and the coal strike in England particularly tended to upset normal conditions. However, this was purely transitory, and there are good signs of a return to more rational conditions. Mr. Llewellyn, in the course of his speech, alluding to American competition in the coal export trade, did not fear anything serious. He pointed out that the average price of coal at the pit-mouth in the eastern fields of the U. S. was about $2 per ton, and to deliver that at a port of shipment meant the addition of $6 per ton in freight, making the coal $8 f.o.b. at American port. There is then the freight across the Atlantic to pay, which makes the lowest price at which U. S. coal could be put in the European market around $14 per ton. The actual price that American coal had been offered at was $15 to $15.50 per ton. This was a competitive figure as prices were then ruling in England, but not a figure which could compete with British prices when costs were nearer a normal level. British costs of production were unfortunately high, and it was this reason only that made America a possibility. Increased production would remedy this state of affairs, and in this connection it is pleasing to note that production is increasing weekly. The coal situation is so closely bound up with the shipping situation that an optimistic outlook on one means also a good outlook for the other, and it is pleasing to note a man who speaks with authority taking such a cheerful view.

* * *

IN connection with the recent agreement arrived at between the Hamburg American Line and the interests associated with Mr. Harriman it is interesting to note that the Royal Mail Steam Packet Co. is about to start a service between Hamburg and New York. This will mean a very live and effective competition for the American lines, as the Royal Mail is one of the oldest and most firmly established of the British lines. Its coming is made the subject of comment by the New York Journal of Commerce, which truly remarks that the U. S. lines will have to face keener competition. It alludes to years of experience and ability behind the Royal Mail Co., evidently feeling that in these two qualities the American companies are lacking.

* * *

THE shipbuilding industry in the United Kingdom is still suffering from the high cost of living, and the policy of the men to give less than a day's work for a day's pay. All authorities on shipping call attention to the fact that ships cannot be operated profitably if built at the present costs. They say that the orders are waiting if the builders can give them fair prices and a reasonably guarantee of delivery. This is just what the builders cannot do with labor in its present state of mind. Ships are continually being held up at various stages of their construction by strikes of one trade or another, and each delay adds to the cost. The peculiar part of it is that the opinion of a great many men is that there is no necessity for reduction of wages if the men would settle down to work. The suicidal policy of ca' canny is what is making the costs of ships so excessive. The men are in some cases beginning to realize that they are killing the goose that lays the golden eggs, but the majority persist in their short-sighted way. With all the handicaps it is pleasing to note that British shipbuilding in 1920 regained its lost place in the leadership of the world, and if 1921 shows an increase in the same proportion, things may yet be well.

* * *

THE evils of pilfering from docks and in transit have reached a stage where they can be no longer neglected, and in this connection a strong committee is being formed, with representatives from Lloyd's, the port of London authority, H.M. Customs, and other prominent bodies interested in this question. The need for action is strongly shown by the following figures. The claims for pilferage passed by Lloyd's Claims Bureau from Sept. 27, 1919, to Nov. 6, 1920, amounted to over half a million pounds, or nearly 10,000 pounds per week. Besides this there are large sums paid by insurance companies outside the bureau, and losses borne by merchants and shippers who have no insurance. In this connection it is stated that one shipping line alone paid 250,000 pounds in one year.

* * *

SOME interesting figures are now available on the number of motor ships built in the last twelve months. The total number put into commission was twenty-four, of which eight were built in Great Britain. There are now under construction 170, of which Great Britain is building between 40 and 50, and it is expected that about half this number will be put into service during 1921. This will mean an addition of between 700,000 and 800,000 tons to the motor fleet of the world. Although not the largest, the motor ships Glenapp and Glenogle are probably the most interesting of the vessels built. The number of engineering firms now manufacturing internal combustion engines is steadily increasing, and includes some of the largest and best known engineering firms in the U. K.

* * *

THERE has been little alteration in the freight markets during the past few weeks, and what has taken place has been on the downward direction. It seems that before any improvement is noted there will have to be a wholesale laying up of tonnage. In this connection the U. S. Shipping Board comes forward with a suggestion that there be an international laying up agreement. No doubt the Shipping Board would like to see such a consummation, but in view of the past features of U. S. Shipping Board ship operation it is doubtful if any other country ship owners will be willing to meet them half way. The new fleet is costing the American taxpayer an enormous sum of money, and anxious as the Board is to sell their ships, private owners show no inclination to buy at the prices asked. These have come down now to $125 per ton, but this is considered far too high, in view of present freight rates and the high wages paid on U. S. ships.

A 250 Ton Ship Crane for the U.S. Navy

Some Interesting Particulars of a Giant Floating Crane Which is Being Constructed and Which is to be Mounted on the Hull of the U. .S Battleship "Kearsarge."

By A. F. Case, Engineer, Wellman-Seaver-Morgan Co.

THE Navy has recently awarded a contract for the construction of a 250 ton revolving crane to be mounted on the hull of the United States battleship "Kearsarge."

The crane will be so constructed that the craneship will be seaworthy as it is the intention to transport the ship, under its own power, with turrets and guns on board, to any port where the crane service is required. This will be the largest seagoing crane ever constructed.

The construction will be under the direction of Rear Admiral D. W. Taylor, Chief Constructor of the Navy Bureau of Construction and Repair. The crane proper will be designed, and erected on the "Kearsarge" at the League Island Navy Yard, Philadelphia, by the Wellman-Seaver-Morgan Company of Cleveland, Ohio. All of the work of preparation of the hull to support the crane will be done by the Navy Department.

The battleship "Kearsarge" with her sister ship "Kentucky" was launched at Newport News, Virginia, on March 24th, 1898, and was the first battleship to have super-posed turrets. The length overall is 375 ft., beam 72 ft., draft 23 ft. 6in., displacement 11.520 tons. Her indicated horse power was 11,900 and her trial speed was 16.82 knots per hour.

Preparatory to the mounting of the crane, the guns, turrets and armor will be removed, and a circular steel foundation, sixty feet in diameter, will be constructed on the deck. To this foundation the rails for the rotating structure will be secured, for the crane will be of the rotary, hinged jib type. Bulges will also be constructed along each side of the present hull, making a total beam of 92 feet.

The crane proper will consist of a rotating platform to which the jib will be hinged. The jib will be an enormous structure, even in itself, for it is required to handle its maximum loads at far reaches and great heights. Two main hoist blocks, each having a capacity of 125 tons will be suspended from the jib, side by side, from sheaves fixed in the structure. A 40 ton auxiliary block will be suspended from a trolley which travels lengthwise of the jib between the main hoists.

An equalizer, with a single hook, will be used to connect the main hoist blocks together when handling the maximum load of 250 tons.

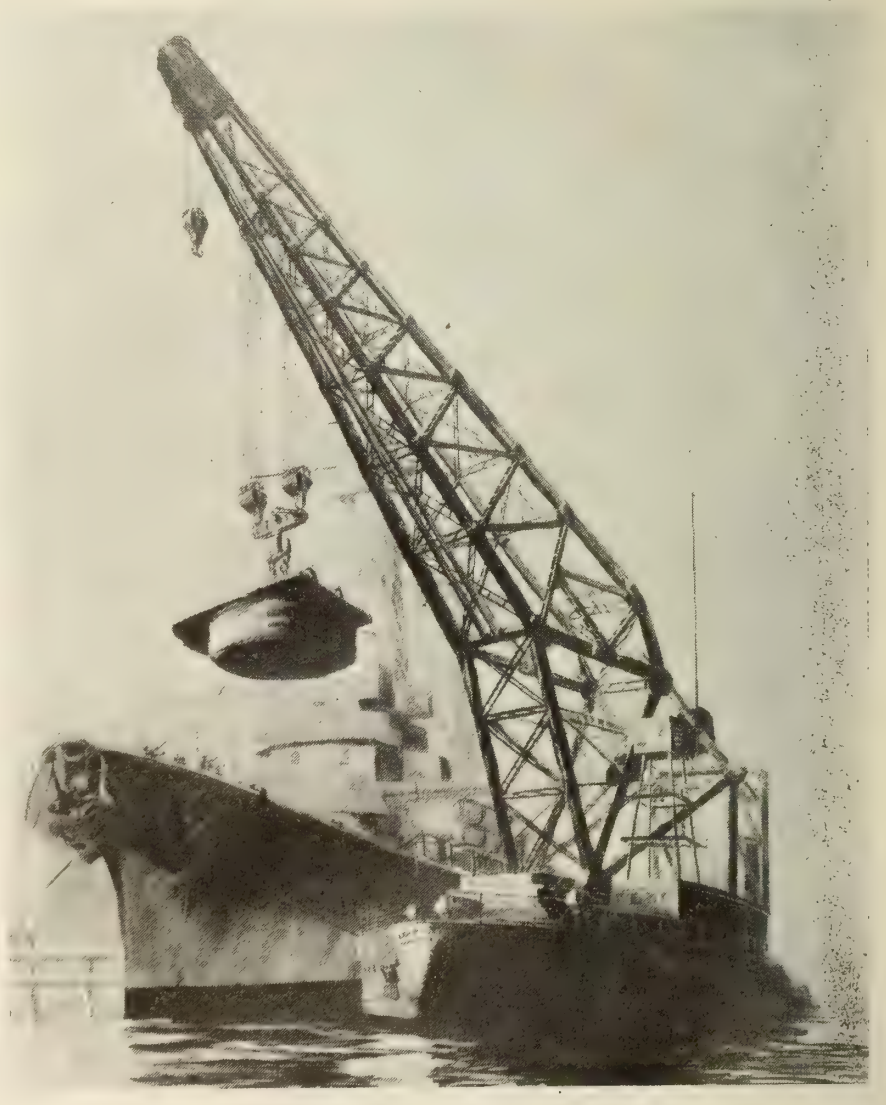
The jib will be capable of luffing in a vertical plane about its hinge pins, this motion being obtained by two massive screws which operate nuts attached to the elbow of the jib and to a steel back frame built up at the back of the rotating platform. The range of these screws is sufficient so that the jib may be luffed to all working positions and also to a position approximately horizontal, when its outer end will rest in a cradle, provided at the after end of the ship, for this sea-going transport position. After the jib has been lowered into the cradle, the entire rotating structure is locked by means of motor operated wedges, to prevent rotation. A special device will also be arranged so that the screws can be slacked off to allow the jib to rest securely in the cradle.

The rotating platform will rotate about a central pivot located within the circular foundation. A system of equalized trucks, attached to the platform, will travel on heavy rails attached to the foundation. There will be four rings of these rails, located in pairs, four feet apart and having a mean diameter of sixty feet.

Intermediate between the rails a bevel gear ring will be attached to the foundation, and, meshing with this gear will be two bevel pinions which will be connected to separate driving motors on the rotating platform. These pinions will be diametrically opposite at each side of the platform so that deflections in the structure under load will not affect the mesh of the teeth.

All of the hoisting and rotating machinery will be carried on the rotating platform, ropes from the drums being led around deflecting sheaves in the back frame and thence to the hoist sheaves in the jib.

The various functions of the crane will be controlled from an operating tower located at the right side of the jib, on



GENERAL VIEW OF CRANE ON HULL.

THE U.S.S. BATTLESHIP "KEARSARGE."

the rotating platform. From this station, high above the deck, the operator will hoist or lower the loads hanging on the hook blocks, move the auxiliary trolley in or out on the jib, luff the jib up or down, or rotate the entire crane. There is no manual labor connected with these operations. All of the motors are governed by automatic control and the operator is required only to turn the small handles of his master controllers to make the giant do his bidding.

The back of the rotating platform will be counter-weighed to compensate for the eccentricity of the extreme weights which the crane will handle. For this purpose it is proposed to use about 400 tons of the old armor plate removed from the ship. This will first be placed in position and then imbedded in concrete to secure it in place.

For the operation of the various functions of the crane, direct current at 220 volts will be supplied by a generating plant to be installed in the ship. Leads from this generator will pass through the center pin and terminate in contact rings from which the current will be collected by sliding contact shoes.

The general arrangement and principal dimensions of the crane are shown in the accompanying cut. Each of the main hoist blocks will handle a load of 125 tons at a radius of 101 ft., and when connected with the equalizer, the maximum load of 250 tons at the same radius, has a vertical range from 40 feet below the deck to 103 feet above the deck. The minimum radius of the main hoist, with the jib in its highest position, will be 72 feet.

The auxiliary hoist will have a capacity of 40 tons, with a maximum reach of 174 feet horizontally. At a radius of 114 feet the vertical range will be from 40 feet below to 135 feet above the crane foundation. This hoist will operate at full load with the jib in any position.

It is interesting to note that the outer end of the jib, when in its highest position, is about 190 feet above the water, and with the jib in its lowest position the extreme end is 102 feet beyond the side of the ship.

The operating speeds of the different functions of the crane will be as follows:

Main Hoist—full load, 6 f.p.m.

Main Hoist—no load, 10 f.p.m.

Auxiliary Hoist—full load, 14 f.p.m.

Auxiliary Hoist—no load, 30 f.p.m.

Auxiliary Trolley—jib up—full load, 20 f.p.m.

Auxiliary Trolley—jib up—no load, 35 f.p.m.

Auxiliary Trolley—jib down, 50 f.p.m.

Rotating—full load—one revolution 12 minutes.

Luffing—extreme positions, 20 minutes.

Identical motors will be used for all operations of the crane. They will be of enclosed mill type, series wound and will have a rating of 110 H.P. for one half hour. Eight of these motors, forming the power equipment of the crane will be distributed; one to each of the main hoists, one to the auxiliary hoist, one to auxiliary trolley, two to the rotating and two to the luffing mechanisms. An electrically operated disk brake will be applied to each motor, so arranged as to set when the current is cut off. Flexible couplings will be used to connect the motors to their pinions.

The motor with its flexible coupling, pinion, brake and bearings, is mounted on a cast bed plate to form a standard power unit, which will be identical for each of the mechanisms. The motor pins and their gears will be of herringbone type, with teeth ground and hardended.

Each of the 125 ton main hoist blocks will be suspended by eight parts of 2 in. steel cable, reeved in a double four part system, the cable ends passing over deflecting sheaves to the machinery house where they are connected to separate drums geared to a standard power unit. The two main hoists will be so arranged that they may be coupled together for simultaneous use.

The 40 ton auxiliary hoist block will be suspended from the trolley by eight parts of 1¼ in. steel cable reeved in a double four part system. The two cables will be anchored to the inner end of the jib, and after reeving through the trolley and block, will pass around sheaves at the outer end of the jib and back to the auxiliary hoist mechanism, the ends being attached to two drums geared to a standard power unit.

On account of the inclination of the jib, a greater amount of power is required to move the trolley toward the outer end of the jib than in the reverse direction. A double two part system of 1¾ in. cable will be used for the outward travel and two 1 in. tail ropes will be provided. The two large ropes will be anchored at the outer end of the jib and lead around sheaves in the trolley, then around the end of the jib and back to the trolley mechanism, where they will be anchored by two large winding drums. The tail ropes will lead directly from the trolley to a drum of one half the diameter of the large ones, thus compensating for the two part system on the outer end. All of the drums are geared to a standard power unit, as in the case of the other mechanisms.

The two independent power units for

rotating the crane are located at each side of the platform and each geared to one of the bevel pinions which mesh with the gear ring attached to the foundation. There is no mechanical connection between these two units, equilization of the rotating loads being produced by the characteristics of the motors, which holds them in electrical balance. In case of accident to either motor the other is capable of revolving the crane at reduced speed.

Luffing of the jib, up or down, will be accomplished by varying the distance between the back frame and the elbow of the jib. For this purpose, four large screws will be used, two having right and two left hand threads. These screws will be arranged in pairs at each side of the jib, one right hand and one left hand being placed end to end and coupled together at the center, the ends passing through nuts supported on trunnions in the back frame and the jib. These screws will be turned by gears attached to the center couplings. On account of the extreme angle through which the jib is luffed, there is great variation in the distance between the nuts, and in order to prevent undesirable deflections in the screws when fully extended, a luffing strut will be introduced. This strut will be a pin connected to the jib at a point midway between the hinge pins and the nuts, and its upper end will be supported on trunnions at the center of the screw couplings. In addition to supporting the screws, this strut also forms a support for the luffing mechanism, which will consist of two standard power units geared to the screw coupling.

The screws will be 15 in. in diameter, of alloy steel, heat treated, and will have buttress threads four inches in pitch. The nuts will be over four feet in length, of manganese bronze, and will be supported in steel trunnion castings.

A Description of a New Reversing Turbine

An 8-inch Model of This Turbine Has Been Tested Out by Prony Brake and Also in Driving a Forced Draught Fan, and Gave Good Results.

THE present invention relates to improvements in a steam turbine and the main object is to provide a device of this character whereby a steam supply will be automatically regulated or cut off. A further object is to provide a turbine of simple design and particularly cheap of construction. Another object of the invention is to provide means whereby a steam chamber is provided with an eccentrically disposed drum thereby allowing for steam expansion, said drum being provided with a central rotating paddle which is slidably mounted in said drum.

The invention will be better understood with the following accompanying drawings, in which:

Fig. 1 is a side elevation of the turbine, the upper half portion being shown in a longitudinal section. Fig. 2 is a cross section view on line A-A of Fig. 1. Fig. 3 is a front elevation of the steam supply valve controlling device. Fig. 4 is a longitudinal section view on line B-B of figure three (3). Fig. 5 is a cross section view through the eccentrically mounted drum.

Like numerals of reference indicate corresponding parts.

In the drawing, Part 1 indicates the base and part 2 is a circular casing having at one side thereof an opening (Part 3) closed by a plug. Parts 4, 5 and 6 are outlet and inlet steam passages provided in the sides of said casing, said passages communicating at one end with the interior of said casing and Part 2 at their other end with a circular valve casing, Part 7 which is preferably integral with said casing (Part 2) at each open end of said casing (2) are cover plates. Parts No. 8 and 9 which are suitably secured thereto by means of the bolt (Part 10). Each of the said cover plates No. 8 and No. 9 are provided with corresponding eccentrically disposed openings (Parts 11 and general bearing No. 12) in which is rotatably mounted the cross shaft Part 13. Rigidly secured on said cross shaft Part 13, is a drum, (Part 14) which is preferably of same width of said casting (Part 2) and is provided with a central slot (Part 15) which projects therethrough and is adapted to register with the slot (Part 16) in the shaft (Part 13). The said drum (Part 14) may be provided with a plurality of longitudinal packing strips (Part 17) which are provided to form a staunch friction joint between said drum and portion of said casing 2.

The drum (14) being eccentrically mounted in relation to the casing Fig. 2. forms a steam expanding chamber (18) which is adapted to communicate on each side of said drum with the outlet and inlet passages (5 and 6).

Movably mounted within said slots 15 and 16, in the drum and cross shafts is a rectangular blade (19) which is provided with curved ends adapted to be in continuous contact with the inner circumference of said casing (2), said blade being provided with a plurality of friction members (20) mounted in suitable recesses and so arranged as to contact with the side of the casing or the inner sides of the slots (15 and 16) by means of the spiral springs (21) which are enclosed in suitable recesses.

The valve recess (7) is provided with a passage (22) adapted to register with the passage (23) provided in the valve casing (24) which is suitably secured to the casing (Fig. 2) and 25 is a circular valve casing provided with the steam inlet (26) to which is preferably connected the steam supply pipe.

Intermediate of said valve casings 7 and 25, is a hole 27, adapted to communicate with the passage 22 and which may be used as an independent steam inlet when suitably connected to the steam supply pipe. The valve casing (7) is also provided with an exhaust opening 28 and 29 is a circular valve member rotatably mounted in said casing (7) and provided with a central passage (30) of a funnel shape at one end thereof which is adapted to register with the passage 22 and one of the passages 5 or 6 at the other end and 31 are exhaust passages provided on each side of said central passages and which are adapted to communicate with one of the passages 5 or 6 and the exhaust port or opening 28.

In the valve casing 25 is rotatably mounted a valve member 32 having a central passage (33) which is adapted to register with the passage 22 and steam inlet 26. The valve members 29 and 32 are preferably provided with outwardly projecting stems 34 and 35, the stem 34 is preferably manually operated by any suitable means, while the stem 35 is automatically operated by a cam (36) which is rigidly secured on one end of the shaft (13) and on which cam is slidably mounted a sleeve (37) which is operatively connected to the adjustable member 38 slidably mounted on the frame 39 by the connecting arm 40. The frame 39 is rigidly mounted on the stem 35 and 41 is a threaded pin having a cross head or handle 42 adapted to adjust the slidable member 38.

In the operation of the invention, the steam enters through the inlet 26, passes through the passage 33 in the valve 32, the passage 23 which communicates with the funnel shaped passage 30 into one of the passages 5 or 6.

Steam enters the chamber 18 in the chamber 2 which is so divided as to provide for the proper expansion of the steam at the same time causing the rectangular blade 19 slidably mounted in the drum 14 to revolve, until it passes by the exhaust passage provided in said casing (2).

In the drawings, the exhaust passage 5 registers with the exhaust port 31 provided in the valve 29 and the exhaust steam passes through the said 31 and enters the steam outlet 28 provided at the end of said valve casing (7). To reverse the turbine the stem 34 may be operated.

When the rectangular blade 19 has reached a predetermined point the steam supply through the inlet (26) is auto-

matically cut off by the valve (32), which is operated by the cam (36), provided on the shaft 13.

It will readily be understood that the intermittent cutting off of the steam is regulated by screwing or unscrewing the threaded pin (41), which distances or approaches the slidable member 38, on which is pivotally secured the connecting rod (40), secured on a cam sleeve (37).

What I Claim as My Invention Is:

1. A turbine comprising a main casing, having an inlet and outlet port, a rotary drum eccentrically disposed within said casing, rotating blade adapted to contact at each end with inner circumference of said casing and adapted to rotate said drum substantially as described.

2. A turbine comprising a main casing having inlet and outlet ports, a shaft eccentrically journalled in the side of said casing, a drum centrally mounted on said shaft and adapted to provide a friction contact with one side of said casing, a slot provided centrally through said drum and shaft and an operating blade mounted on said slot and adapted to contact at each end with the inner circumference of said casing substantially as described.

3. A turbine comprising a main casing having an inlet and outlet port, a valve adapted to contact said ports, a rotating drum eccentrically mounted within said casing operating blade contacting at each end with the inner circumference of said casing and adapted to rotate said drum and means whereby said valve may be opened or closed automatically at a predetermined time, thus limiting the steam supply to said casing substantially as described.

4. A turbine comprising a main casing having an inlet and outlet ports, a valve adapted to control said ports, a rotating drum eccentrically mounted within said casing, a blade contacting at each end with the inner circumference of said casing and adapted to rotate in conjunction with said drum, means whereby said valve may be automatically opened or closed at the predetermined time to limit the steam supply to said casing and means to adjust said valve substantially as described.

5. A turbine comprising a main casing having an inlet and outlet ports, a valve casing adjacent said main casing, a passage communicating at one end with each of said ports and at the other end with the said valve casing, and said valve casing having an exhaust port and an inlet port, a rotary valve mounted in said valve casing provided with a steam inlet and steam outlet adapted to register with the passage communicating with said valve casing, a steam supply valve casing, a passage adapted to connect the steam inlet in the aforesaid valve casing to said steam supply valve casing, means to supply steam to said valve casing, a rotary valve member mounted in said casing, a rotating drum eccentrically mounted in said casing, a movable operating blade contacting at each end with the inner circumference of said casing and adapted to rotate said drum, and means whereby said steam supply valve may be opened or closed automatically at predetermined intervals to limit a steam supply to said casing substantially as described.

6. A turbine comprising a main casing having an inlet and outlet ports, a valve adapted to contact said ports, a shaft eccentrically journalled in the sides of said casing, a rotating drum mounted on said shaft, an operating blade adapted to project through said drum and contacting at each end with the inner circumference of said casing, a cam mounted at one end of said shaft adapted to revolve said valve and means to adjust the time intervals between the opening and closing of said valve substantially as described.

This model of steam reversing turbine was in operation in a small way, an 8 in. model, and was tried last fall, on November 24th, at Levis, Que., at which time it developed 11.7 B.h.p., but this turbine shows to a better advantage when worked with vacuum and will develop more power. As I said before, it was tried with only 90 lbs. pressure and gave the above result. It turned 600 r.p.m. with a load of 27½ lbs. at the end of a 28 in. lever. It was also tried in another place to run a fan on board a vessel (Howden System Draft), to take the place of an engine 4½ in. x 7 in. At another place it was in-

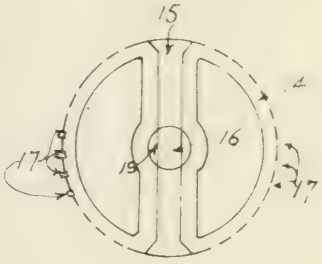


FIG. 5.

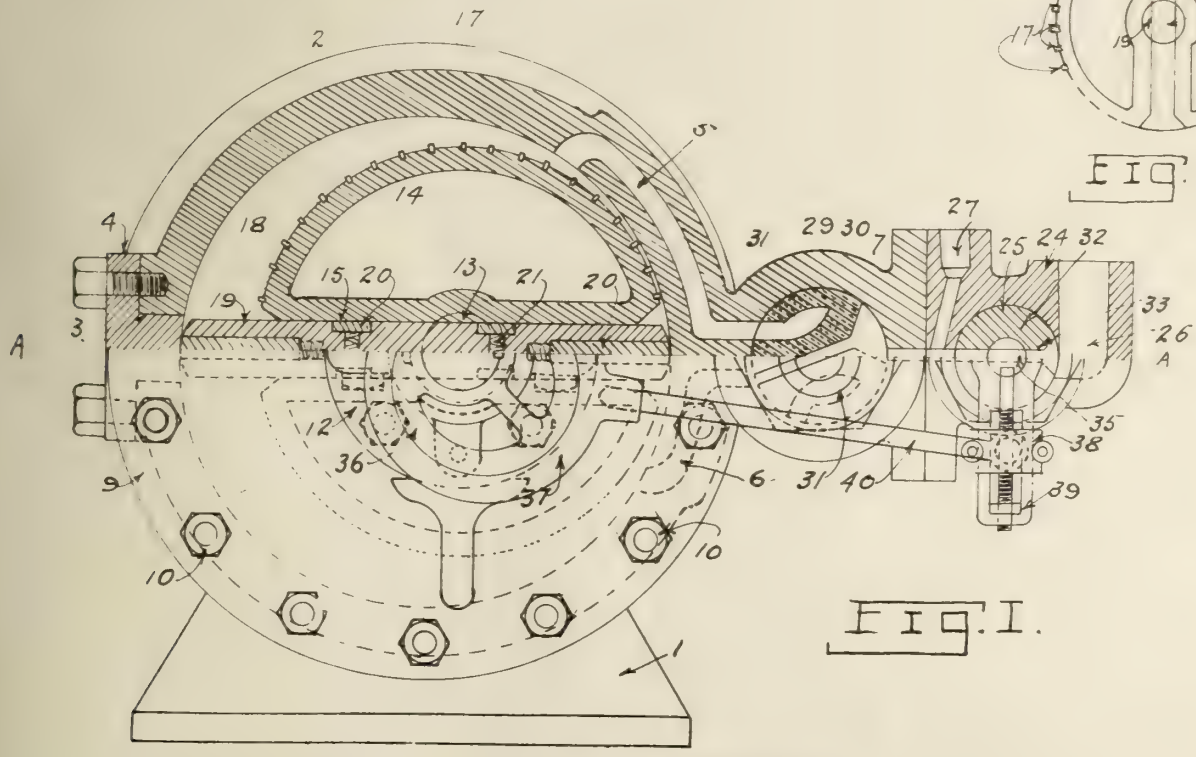
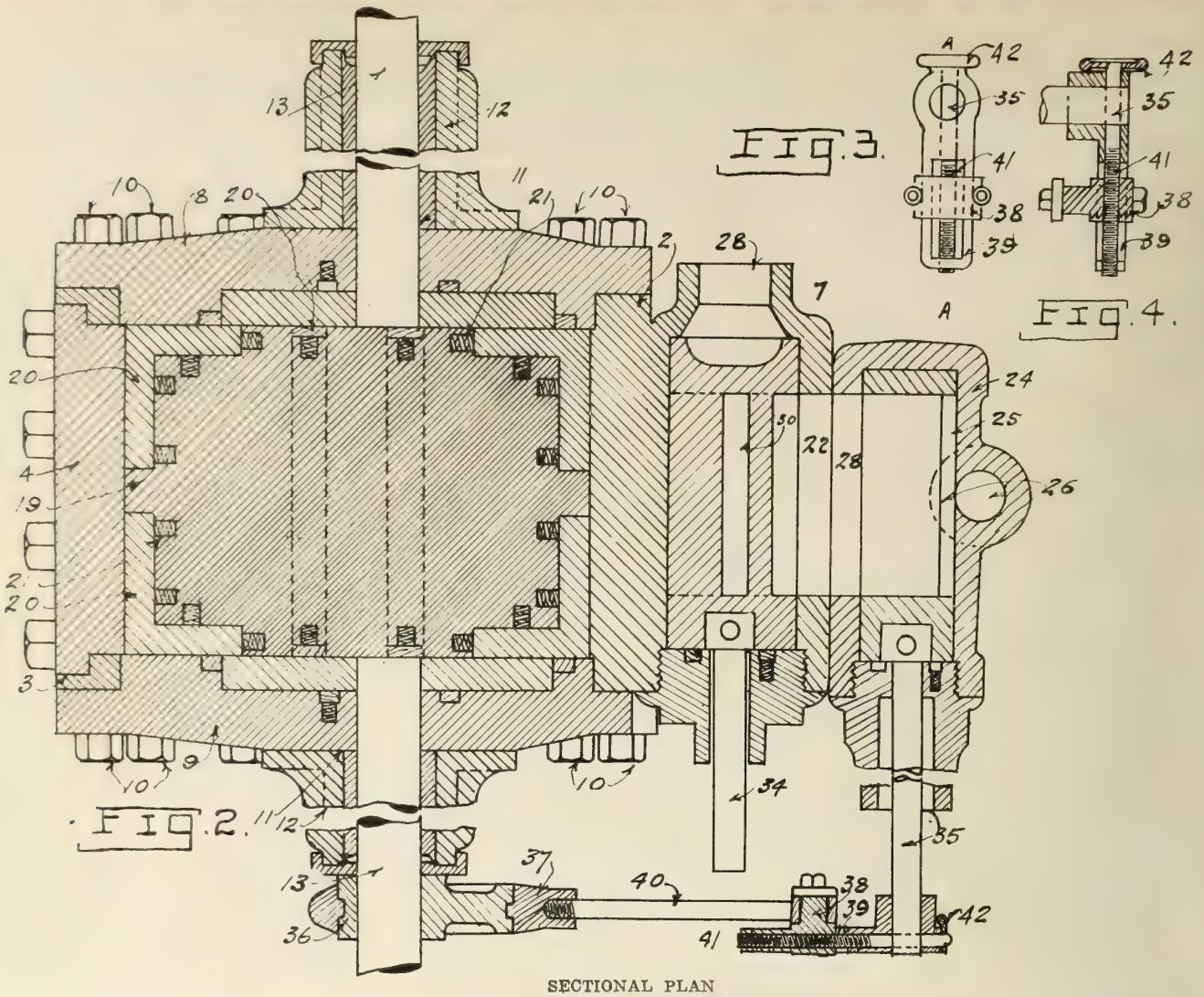


FIG. I.

SECTIONAL ELEVATION.



stalled to run a dynamo for 64 lamps and in all of the cases it gave better satisfaction than the engines did before, and besides was run at a great economy over the cost of running the engines.

SHIPPING INTERESTS UNITE AGAINST GRATUITY SYSTEM

Close co-operation with the authorities charged with enforcement of Federal and State laws against unfair trade practices in shipping circles is the principal object of the American Ship Service Corporation just organized under the laws of Louisiana.

The custom of giving secret commissions and gratuities in connection with the sale of ship supplies and the repair of vessels has been practically universal in all parts of the world for at least a century. Convinced that there is no longer any place in American business for this method of competition, the majority of representative firms in the industry have been working heartily with the Federal Trade Commission at Washington during the past year in its efforts to relieve them of the heavy burdens of the gratuity system.

Criminal legislation recently enacted in Louisiana prohibits the solicitation as well as the giving of gratuities, and expressly disallows evidence of custom as a valid defence. The passage of this statute is the result of the vigorous stand taken by ship supply and ship repair companies who have long desired to completely eradicate this pernicious trade custom.

Through the American Ship Service Corporation it is proposed to co-ordinate the efforts of the shipping interests at the various ports and carry forward the work already accomplished by them with the aid of the United States Government. An appeal will be made to Congress and to coast states for criminal legislation similar to that passed in Louisiana, and it is believed that this movement will be strongly supported by owners and steamship agents, as well as by a number of other industries having a common interest in abolishing the gratuity system.

The organization of the American Ship Service Corporation is further evidence that the industry does not intend to permit the continuance of this trade evil nor to allow redemial legislation to become a dead letter.

The best business sentiment in the shipping industry is expressing a desire to participate in the affairs of the new corporation. Among those already represented are:

New Orleans—Woodward, Wight & Co., Ltd.; Rolf Seeberg Ship Chandlery Co.; Menge Marine Hardware & Supply Co., Inc.; Stern Foundry & Machinery Co.; Crescent City Machine & Manufacturing Works; John Alsina Co., Ltd.; New Orleans Machine Works; Alex. Dussel Iron Works; New Orleans Ship Chandlery Co.; Jahncke Dry Dock & Ship Repair Co., Inc.; Orleans Iron Works, Inc.; Herbert H. Ruch; Goodman & Beer Co., Inc.; J. O. Elmer Co., Inc.; Southern Machines Works; Frolich Iron Works, Inc.; Brooks & Allen; J. H. W. Steele Co.

Galveston — Black Hardware Co.; Flood & Calvert; Galveston Dry Dock & Construction Co.; Voight Machine Shop; Vulcan Iron Works; John W. Focke; Peter Gengler Co., Inc.; McDonough Iron Works; Gulf Iron & Machine Co.; Ullmann, Stern & Krausse, Inc.; The Model Market; The J. H. W. Steele Co.; Brooks & Allen; Gray's Engineering Works.

Port Arthur—Texas Machine Works.

Mobile—Rolf Seeberg Ship Chandlery Co.; Henderson Shipbuilding Co., Inc.; Home Industry Iron Works, Inc.; Alabama Dry Dock & Shipbuilding Co.; Hodges Boiler & Machine Works Co., Inc.; Cowles Ship Supply Co., Inc.

Pensacola—W. A. Ray Hardware Co.; John A. Merritt & Co.; Pensacola Shipping Co.

Jacksonville—George E. Chase & Co.

Savannah—Marine Hardware & Supply Co.; Wilkinson Machine Co.

The Use of Superheated Steam at Sea

SUPERHEATED steam is defined as being steam which contains a surplus of heat, which is to say that it has a temperature greater than that of saturated steam at the same pressure. This is equivalent to saying that it contains no free moisture such as is contained in ordinary saturated steam. With saturated steam the free moisture contained in it may collect and the results of water, even in moderate quantities, are well known and evidenced by broken cylinder heads, bent pistons, etc., in reciprocating engines and, when turbines are used, by the erosion of turbine blades and buckets. With superheated steam these conditions are eliminated and the steam has more nearly the characteristics of a perfect gas. The operation, therefore, with superheated steam approaches the ideal with respect to the efficient use of the steam.

The question naturally occurs to you why should superheated steam be used; what advantages has it? If the steam is used more economically in the engine a smaller quantity naturally has to be delivered by the boiler, and if we have to evaporate less water we do not need so much coal. This saves money for the owners and saves labor in the fireroom. Fuel economy, therefore, is, generally, the first point of advantage. In the second place if we are using a smaller quantity of steam and the boiler does not have to evaporate so much water there is a reduced amount of corrosion and deterioration of the boiler parts; there is a decreased amount of work to be done by the condenser and a smaller volume of water to be made up and supplied to maintain the proper amount of feed water. This cuts down the amount of time the evaporators and distillers have to be operated and decreases, in the same proportion, the amount of cleaning and repairs necessary on these auxiliaries. The decreased amount of water normally required when superheated steam is used means that the boilers become freer steamers, and less difficulty is experienced in maintaining working pressure. If the quantity of fuel used on a voyage is decreased by the economies above referred to, less coal has to be put aboard; there is labor and time saved in bunkering and the amount of cargo carried can generally be increased by an amount equal to that saved in bunker coal.

For the same reason the steaming radius with the original amount of bunkers is increased, and when it is necessary to bunker in a home port for a round trip to a foreign country every ton saved in bunkers means two tons available for added cargo, in addition to the saving obtained through the purchase of fuel in the home port.

When superheated steam is used it is necessary to provide internal lubrication of the steam at the high pressure chest. The arguments have been advanced that this is an undesirable and prohibitive condition. The fact that more than two thousand vessels are using highly superheated steam successfully today, and that more than fifteen hundred of these ships are fitted with reciprocating engines which are being supplied with oil is ample proof that this is a condition that has been satisfactorily and safely solved. It has also been a source of fear to some people that if oil were used in this manner it would be impossible to remove it from the feed water and that oil would collect in the boiler. These fifteen hundred ships that have just been referred to have been proven to be free from this condition, and in the dozens of ships that I have inspected I have yet to find a case of where oil has caused damage to combustion chamber or furnace, and, what is more, I have failed to find anybody who has heard of a case that is attributed to oil because of superheated steam being supplied.

It is sometimes claimed that lubrication is unnecessary with superheated steam. This is an erroneous statement. If a reciprocating engine can be operated successfully without oil in the H.P. chest you can be assured that it is using saturated steam, and if you are using superheated steam you must provide oil for lubricating purposes because there is no water in superheated steam.

The wear of piston rings, when superheated steam is used, has also been feared, but this too has been demonstrated as having been successfully taken care of.

It may be of interest to describe briefly the various principles on which superheaters have been constructed. They are broadly divided into two classes:

1st—Separately fired superheaters.
2nd—Integrally built superheaters.

Separately fired superheaters are separate from the boiler and its connections, in reality being something like a water-tube boiler with its own furnace and uptake. The steam from the boiler is led to the seperately fired superheater, is superheated within it and from it goes to the engine. Separately fired superheaters are practically extinct. They were used some twenty years ago, but it was found that the space they occupied, and the low efficiency which they had, did not result in a net economy that made their installation profitable.

Integrally built superheaters may be divided into three sub-classes:

1st—The waste-gas type.
2nd—The live-gas type.
3rd—The combustion chamber type.

The waste-gas, or uptake type of superheater, is located so as to be in the path of the gases after they have left the boiler evaporating surface. In Scotch boilers the location would be in the uptake and in water-tube boilers it would be above the boiler tubes; sometimes within the boiler casing and sometimes in the breeching. If the boiler has been properly designed the temperature of the waste gases is sufficiently low to prevent more than a very moderate degree of superheat, even under the best conditions. Under adverse conditions, which are commonly met with at sea, these superheaters will almost always fail to deliver any superheat and in many instances have actually permitted water to pass through and reach the engines. It is this limited capacity that has caused the abandonment of waste-gas superheaters in all countries operating a successful merchant marine.

Live-gas superheaters are so located as to permit them to receive heat from gases which have not yet left boiler evaporating surface. In Scotch boilers this type is best known by the fire-tube design of superheater, which is the type installed on the two thousand and more vessels mentioned a few moments ago. In water-tube boilers live-gas superheaters are located between the boiler tubes, the position depending on the degree of superheat desired.

The combustion chamber type of superheater has thus far not met with favor in marine practice. It is, as its name indicates, located in the combustion chamber, or at some point where the gas temperatures would ordinarily be above 1,800 degrees Fahrenheit and would, therefore, require special protection to prevent burning out. The necessity for its use is, up to the present time, not sufficient to take these risks, for the reason that all degrees of superheat which can be utilized in reciprocating engines or turbines can be delivered by other types of superheaters which are more durable, and have other incidental advantages. In stationary practice ashore combustion chamber superheaters have been used in special cases with great advantage.

In the selection of a superheater, a number of points should be considered. In the first place, the superheater should be **simple** in construction. It must be easily installed and its details shall not be complex or require any unusual methods or tools in its assembly. In the second place the superheater must be **accessible.** It should be easily reached for inspection and repairs and in the event that any part of the boiler required repair, the superheater, if it is adjacent to such a part, shall be easily removed and reapplied without destruction of any part and without great labor and cost in tak-

ing it out; in the third place, the superheater should be **flexible.** It should be free to expand and contract, as temperture conditions vary, without putting strain on any of its parts or joints. This is a feature that was not provided for in early design of superheater and was one reason for their failure. In the fourth place it should be **safe.** Its construction, both with regard to the material used and the size and shape of the different parts, should be such that if, for any reason, a failure occurs it will not endanger life or property. In the fifth place, is must be **durable.** Its construction and operating conditions must be such that it will not be damaged by shutting down or in firing up. It must be so designed and located that in service it will not be exposed to excessive temperatures which will cause a short life to its parts. Admiral Dyson, in a paper published in the Journal of Naval Engineers explaining why superheaters were omitted from certain ships, said, "Superheaters, while very desirable, were omitted as experience has demonstrated that superheaters fitted in uptakes outside of the boiler lack durability." Fire-tube superheaters, most widely used in merchant service, have an average life of ten years or more, while in locomotive service, where conditions are far more severe, they show more than eight years life. In the sixth place, it must be **renewable.** If parts are damaged for any reason spare parts must be easily applied without the necessity of work being done aboard ship to fit some piece of material in place to serve as a temporary repair. This condition is not yet provided for in many designs of superheaters. In the seventh place, is must be **efficient,** which means that it must, without added care, be capable of developing, under ordinary and even extreme operating conditions, the degree of superheat for which it was designed. In the eighth place, is must be **cleanable.** That is, it must be so located and designed as to be free from accumulation of soot and cinders, which detract from its efficiency, or if such perfection is not possible it must be so constructed as to permit the easy removal of collections of dirt and soot in an easy and thorough manner. Many superheaters are located in low gas temperatures and accumulate soot very rapidly. The removal of this soot is necessary and when the surface of the superheater is not smooth it becomes difficult, if not impossible, to clean them.

All of these conditions are fulfilled by superheaters which are now in successful service, and it is because of having had appreciation of these requirements that the remarkable success in superheaters has been attained, not only in marine practice but on railway locomotives and in stationary power plants.

The question of what conditions are required for a superheater installation may be referred to rather briefly. It is, of course, necessary to have the proper space conditions for a superheater. In many cases the close location of portions of the ship structure limit the space available for the uptake and limit, sometimes very seriously, the proper application of the superheater parts. Generally, these conditions are not prohibitive and it is almost always possible, even in an existing vessel, to fit fire-tube superheaters without alteration in the uptake. It is also necessary to have the proper materials for steam piping, together with its valves and fittings which have to carry superheated steam. Some materials, copper for example, are not suited for superheated steam, and if the steam pipe should be of such material it should be replaced by steel pipe. The rules of the U. S. Steamboat Inspection Service, Lloyd's and other classification societies permit high-grade cast-iron (semi-steel) ferro-steel and some other material for fittings to be used with superheated steam. It is also necessary, if reciprocating engines are to be used, to have piston valves for the high pressure cylinder. It is desirable, though not necessary, to have piston valves on the I.P., but no change from ordinary saturated steam practice is necessary on the L.P. chest. Piston valve rings and piston rings should be of the best grade of cast iron and should be properly fitted to give satisfactory service. This, however, is a condition that should exist even if saturated steam is used. Rod packing, both for the high pressure valve and piston rod, should be metallic and this detail is also one which needs good construction, even though saturated steam is used. Oil filters or grease extractors are essential, but in reality are no more essential with superheated steam than with saturated steam. All well equipped vessels today, irrespective of the kind of steam that is used, have adequate provision for removing oil from the feed water. It is essential, however, that oil filters be given attention. It is a waste of time and money to put in filters and then not clean them. Soot blowers are also essential whether superheated steam is used or not. You all know the importance of keeping flues clean and it is just as necessary to keep them clean when superheaters are in use as though they were not installed. The lubricating oil which is used should be of suitable quality to withstand the increased temperature of the steam. Most of the vessels now running use either Wakefield's superheater oil, Sun superheater oil, Hecla "B" or extra Hecla oil. These brands of oil are successfully used and there are probably other quality good makes of oil which can be used if necessary.

It is essential that the engineer force be aware of what the superheater is there for and of the characteristics of superheated steam. The same statement is true of any and all equipment aboard a ship. Another way of stating this would be to say that the engine room force be thoroughly familiar with all the equipment aboard.

The question of lubrication has been referred to and many are under the impression that large quantities of oil are required to satisfactorily lubricate the engines. This is a wrong impression and the extra amount of oil required is, under ordinary conditions, comparatively small. Even with the highest degree of superheat it is found that one pint per thousand horsepower per twenty-four hours, when delivered regularly to the steam before it enters the H.P. chest, is an ample allowance. Emphasis should be placed upon the regularity of feeding oil and this is satisfactorily provided by force feed oil pumps actuated from some convenient part of the engine. It is also found that the amount of oil used for swabbing can be decreased compared with what would be needed with saturated steam.

Superheaters, like all other parts carrying steam, must be maintained steam tight. The most widely used and most successful designs are easily maintained in this condition, as all joints are accessible and easily kept tight because of their small size. With the designs of superheater where pipes are rolled into headers attention must be given to the hand-holes opposite the tube ends, and these hand-holes must be maintained steam tight, as well as the unit joints.

In changing a coal burning ship from saturated to superheated steam it is many times desirable to decrease the grate area by shortening the grate. This is almost always a necessity if the area has been adequate when using saturated steam. The reason for the decrease when using superheated steam is because of the decreased amount of fuel required, and the decrease in the grate area permits a sufficiently high rate of combustion to maintain the gas temperature throughout the boiler at an efficient degree. Generally, the reduction in grate area amounts to between 10 per cent. and 15 per cent.

It has sometimes been considered that condensers which were adequate with saturated steam would prove to be too small when used with superheated steam A little thought on this point will assure one that the reverse is the fact. The use of superheated steam results in a decreased amount of water to be evaporated and in a decreased amount of heat exhausted from the L.P. cylinder to the condenser. As a condenser's work is to remove heat from the steam, it follows that there will be less heat to be handled by the condenser than when saturated steam was used, and it has been amply demonstrated that fully as great a vacuum can be carried by the same condenser after superheaters were installed as was carried previously.

The conditions that are necessary for satisfactory operation of a vessel using superheated steam differ very little from using saturated steam.

In an engine room fitted with turbines no differences in operation are called for. If reciprocating engines are used the only additional point is to see that the

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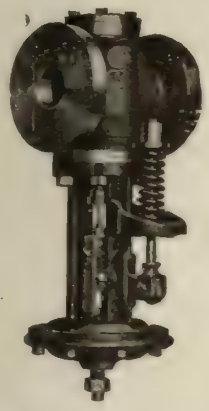

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In the fireroom, before getting under way, the boiler tubes and superheaters should be blown free from dust and soot. Before the throttle is opened the superheater and all piping should be drained to remove water which has condensed during the shut down period. The properly installed superheater is provided with valves and pipes for this purpose.

When firing up a cold boiler the pressure should be brought up gradually and until superheated steam is used, on either the main or auxiliary line, the drain valves on the superheater headers should be cracked, thus permitting a small quantity of steam to flow through the superheater and prevent units from being in any way overheated. This practice should be followed when main engines are not operating, unless a flow of superheated steam is provided to the auxiliary line. **Under no condition should the superheater be flooded with water.** Flooding of a superheater is sure to result in a deposit of foreign matter on the interior surfaces, and will, if allowed to accumulate, seriously interfere with the efficiency of the superheater.

When oil fuel is used the firing need be no different from that followed with saturated steam. When coal is used as fuel it is desirable to carry a little heavier fire near the bridge wall, which, however, is good practice under any conditions, and thus assure a maximum gas temperature in the furnaces. It will be found that firemen will have a tendency to fire too heavily unless they have had experience with superheated steam, and will not at first appreciate that easier firing and lighter furnace and combustion chamber temperatures contribute to the fuel economy. When this is understood they will readily take advantage of the decreased amount of fuel necessary.

It is essential that pyrometers be used for indicating the temperature of the steam, both at the boilers and at the turbines, or engine stop valve. Pyrometers of the electric type have been found most suitable for marine practice. The indicating portion of the pyrometer is conveniently located on the instrument board in the engine room and readings easily made. The engineers on watch will soon find that the indicators showing the temperature of the steam coming from each superheater is an accurate and convenient way of determining the conditions in the fire room, and makes it possible to correct poor firing conditions before it has reached the stage where the boiler pressure falls. Practically all ships properly fitted with superheaters have pyrometers aranged generally, as just above described. It is the only means of determining whether the superheaters are performing in a proper manner and the temperature indications, when used in connection with the boiler pressure, tell the whole story as to the power of the steam going to the propelling machinery. With saturated steam, because the temperature always corresponds with the pressure, a steam gauge is all that is necessary, but when you are using superheated steam the steam gauge alone does not tell the complete story. The pyrometer is necessary to supplement the steam gauge.

Enquiries into Marine Disasters

RE S. S. SOUTH AMERICAN STRANDING

In the matter of a formal investigation held in the Customs House, Halifax, N.S., on January 6th, 1921, before Captain L. A. Demers, F.R.S.A., Dominion Wreck Commissioner, assisted by Captain Neil Hall and Captain C. A. Hunter, acting as nautical assessors, into the stranding of the S.S. "South American," near Little Cape, Gulf of St. Lawrence, at 12.05 a.m., November 18th, 1920.

Mr. L. A. Forsyth appeared for the master, Wm. Fraser.

The S.S. "South American" is a new steel built single screw vessel, owned in Toronto, registered in Montreal, of 251 feet length, 53 feet 6 inch breadth, with a draught of 6 feet 3 inches forward and 9 feet 6 inch aft at the time of casualty, carrying a crew of 28 men. including 3 deck officers,—the third officer not having a certificate,—and four engineers, two having certificates. She has triple expansion engines, with a speed of 11½ knots.

The master, first and second officers were alone available as witnesses, others whose evidence would be material, such as the third officer, who was on watch previous to and at time of stranding, wheelsmen and look out men, having been discharged.

The synopsis and summing up of the evidence heard shows that the master accepted the conditions such as they were, and did not demur against the employment of a non-certificated third officer, therefore accepting all the responsibility which should, in part, be shouldered by the officer in whose watch the casualty occurred.

The master retired to a room connected with the chart room at about 6.35 p.m., after having stopped his ship and given instructions to the chief officer to be called in the event of anything being seen, or an important change of wind. A snowstorm had been raging from 4 p.m., of the 17th. A bearing had been taken of Chlorydorme and afterwards Fame Point, also the sound of the latter fog signal was heard.

Then the ship was hauled more to the eastward and stopped, it being estimated that she was eight miles off, and that the usual current would counteract the effect of the leeway and the ship keep her position.

It is noted that the instructions given were verbal, no night order book being kept. The master retired, not with the intention of sleeping; but to rest, being fully dressed, even to overcoat and cap. He fell asleep and was never wakened till the ship struck 5½ hours later.

The first officer said the wind had hauled to the eastward but two points, and this change was not sufficiently important to notify the master when he left the bridge at the relief of watches.

The second officer had only got on the bridge, and noticing a light off the shore, asked the third officer if he had seen it. The third officer had apparently just left the wheelhouse at the moment of this observation of the light. The second officer rang the telegraph full speed astern, the ship grounding at the same time, her port side abaft amidships first, heading west. The master than came up and ordered boats ready whilst soundings were being taken.

In the face of the above statements the Court is of opinion that the master, William Fraser, was remiss in not giving more specific instructions to be told when the chief officer, Sutherland, was relieved, since he could not, nor did not place any reliance or trust on the third officer's ability as a navigator.

Since he elected to stop his ship and leave her to the mercy of winds and waves, a mode of procedure the Court does not appreciate, the reason given for the stopping of the ship is not considered a serious excuse, because the fact that a sister ship had lost the blades of her propeller was not a reason for holding this ship on her voyage. Since it was ascertained, more by approximation, that the vessel was eight miles off, had she been kept at slow, her propeller would not have been endangered, and the officer would have been in a position to better watch and calculate the progress of the vessel.

With a cast of the lead, even in 150 fathoms, it would have been demonstrated if their calculations as to distance from the land were accurate.

It is apparent, though direct evidence is lacking, that the wind must have veered during the third officer's watch, and he failed to convey the information to the master.

Hence the Finding.

Finding.

The Court having carefully weighed the evidence adduced, finds that the mas-

ter, William Fraser, certificate No. 3909, failed to give such specific, detailed, peremptory instructions such as the occasion demanded before he went below, as to taking a few casts of the lead, and as to being called at the least change. The slightest change at that time, when the barometer was falling rapidly, was of great consequence.

For the above reasons the Court, taking into consideration his straightforward statement, and good work in taking ship out of such a dangerous situation, will not deal with his certificate; but reprimands him severely, and advises him to make it a fast rule for the future to keep a night order book and signify his wishes in writing when his intention is to retire to his room.

The first and second officers are exonerated from all blame.

In view of the fact that the third officer was not present to give his evidence the Court will abstain from commenting on his conduct.

Read in Open Court at Halifax, N.S., this 6th day of January, 1921.

(Signed) L. A. DEMERS,
Dominion Wreck Commissioner.

Concurred in by
(Signed) NEAL HALL,
(Signed) C. A. HUNTER,
Assessors.

RE S.S. "ROMSDALSFJORD"

In the case of a formal inquiry into the total loss of the Norwegian Steamer "Romsdalsfjord" on Sambro Ledges, off Halifax, N.S., on the morning of December 10th, 1920.

Enquiry held in Court House, Halifax, on Tuesday, 14th Dec., 1920, before Capt. Henry St. G. Lindsay, Commissioner, assisted by Captains Neil Hall and J. D. MacKenzie, as Assessors.

Summary.

The S.S. "Romsdalsfjord," of 2,972 tons register, belonging to Christiana, owned by the Norse-American Line, sailed on Nov. 17th, 1920, from Narvic, Norway, with a cargo of iron ore, bound to Baltimore, U.S.A., having a crew of 39 all told, including the master, 3 officers, and 4 engineers, and after a stormy passage was obliged to make Halifax, N.S., being short of coal.

On 9th Dec., 1920, about 10 p.m., the light on Egg Island was sighted, and cross bearings of that and Jeddore Rock Light were taken, placing the position of ship 9½ miles from Egg Island, and 10 miles from Jeddore at 11.17 p.m.

At 1.15 a.m. 10th Dec., cross bearings were taken of Devil's Island and Chebucto Head Lights, and the vessel was then steered direct for Chebucto Light, and the patent log hauled in. At 2 a.m. the "stand-by" to engine room was rung, and at 2.25 a.m. the vessel struck on Sambro Ledges, about 1 mile to the eastward of Sambro Island, becoming a total loss.

The weather until just prior to the striking appears to have been fine and clear with the wind freshening from the Eastward, all the leading lights being visible.

Finding of Court.

From the evidence adduced it would appear to the Court that it is inexplicable that, with all leading lights plainly visible, and with the positions given by two cross bearings, that the vessel was deliberately allowed to run at practically full speed on the Ledges, without any apparent display of ordinary care or judgment on the part of those on board.

The statement of the master of his mistaking Sambro Light for that on Chebucto Head, cannot be justified, seeing that the former one shows one flash every 5 seconds and that the latter shows four flashes every 30 seconds, and these lights were plainly visible for over an hour before the vessel struck, but apparently no comparison of the two was made.

Taking into consideration the cross bearings at 1.15 a.m., of Devil's Island and Chebucto Head, the vessel's position, as shown on the chart, at that time, gives the course and distance to Chebucto Head as S 76 W (True) distance 7½ miles, therefore allowing that the vessel was making a speed of 10 knots, over the ground, which the Court considers as quite possible, owing to the set to the Westward usually found with Easterly winds, off the harbour, in 45 minutes, the vessel would have made that distance, but it was 25 minutes later that the casualty took place, and no reduction of the speed made.

The Court, in taking the above deductions into consideration, is unanimous in their decision that the master, Harry Pay, was guilty of culpable negligence in not taking the customary and proper precautions when approaching land at night, insofar that he did not attempt to distinguish by timing, the difference between the two principal lights on Sambro and Chebucto, and did not steer a safe and proper course after 1.15 a.m. on 10th Dec., thereby causing the loss of the vessel, and do therefore recommend that a copy of both the finding of the Court, and evidence taken, be forwarded to the Norwegian Government, for their information and action.

The Court is also unanimous in stating that the fact of the Sambro Light vessel not being on her station, has no particular bearing on the case at all.

(Signed) H. St. G. LINDSAY,
Commissioner.
(Signed) NEIL HALL,
Assessor.
(Signed) J. D. MacKENZIE,
Assessor.

Victoria, B.C.—The ironworkers at the Yarrow shop in Victoria, B.C., went on strike following a cut in wages of 50 cents put in force recently. The electricians, to the number of 25, also joined the strikers. The total number of men employed numbers about 700.

Vancouver.—The cut that has taken place in ocean rates from Vancouver to British ports is likely to have a big influence on the port of Vancouver as a wheat shipping centre. The rates now are $18 per ton, as compared to $45 a ton, which obtained only a short time ago. The rate is expected to drop still further to $12 a ton. It is stated that in these circumstances the wheat buyers in the Old Country are looking with interest to Vancouver, and many of them consider that Vancouver is the logical centre for grain shipments from the central West.

Toronto.—There is some indignation being felt along the border cities due to a map recently published by a Chicago concern, which shows all the Canadian cities on the lake shores as being in United States territory. Some of the cities included in the U. S. are Brockville, Kingston, Toronto, Hamilton, and on to Sault Ste. Marie. Even Port Arthur and Fort William are annexed by the bland cartographer. It is probable that the sale of the map in Canada will be prohibited.

Hollow concrete posts for use as mine "timbers" have been devised by a Belgian engineer, states the South African Mining and Engineering Journal. The new system, which is designed to permit of settlement if the support is overburdened, consists essentially of a hollow reinforced concrete column, filled with sand or some other slightly compressible material through which the load is transmitted. The arch for the roof is of precast concrete, and is provided with a tenon which fits into the opening of the hollow post. The bottom of the post fits over a tenon on a base block. Spiral reinforcement is provided for the post, which has to resist, at the beginning of loading, the radial pressure of the sand which fills the hollow and which is compressed under load on the frame. If the roof settles, the sand will compress a certain extent, and if the amount is beyond the length of the tenon the post commences to take compression.

The Aktiebolaget Skandinaviska Armaturfabriken has invented and tested a new alloy of copper and aluminum that is worthy of notice. The name that has been given to this new combination is "alcobronze." It has the color and lustre of gold, and it is said to be stronger, tougher and harder than any other bronze. It is further stated that it can be wrought, forged or rolled in any way without suffering deterioration, and that it resists the action of the air, acids and salt water, being therefore particularly suitable for ships' forgings, propellers, condensers, machine parts, bearings, surgical instruments, skates, ornaments, etc.

MARINE NEWS FROM EVERY SOURCE

Berlin.—Reports here state that a German professor has invented a super-submarine, and regrets are expressed that he did not make his discovery a few years ago. The invention, it is claimed, consists of a method of armour plating, which will make the submarine impervious to depth bombs and enables them to dispense with ballast. The range of action will be increased, and its power as a surface fighter much enhanced. Patents have been applied for in all countries.

* * *

Gloucester.—The famous "Esperanto," the fishing schooner that won the races off Halifax last year, is up for sale, together with some other vessels of the same owners. She is owned by the Gorton-Pew Fisheries Co. The cup will be defended next time by probably a new schooner, though it is said that there are several faster schooners than the Esperanto sailing out of Gloucester.

* * *

Tokio.—The ice breaker Baikal, which was blown out of the harbor of Alexandrovsk during a storm recently and imprisoned in the ice off the coast, has been found by means of airplanes, which got into communication with her. They have since then again lost touch, and much anxiety is felt for the vessel and her crew.

* * *

Ottawa.—At a meeting of the various organizations connected with the navigating side of the marine business, consisting of shipmasters, pilots, and officers, it was decided to form an amalgamation of the various interests. The new organization will be known as the Canadian Navigation Federation.

* * *

Montreal.—The Canadian Government Merchant Marine occupies a unique position in connection with trans-Atlantic freights, being the only line which accepts payment in Canadian funds, all the other lines in the Conference insisting on freights being paid in New York funds. This has resulted in a large amount of business coming to the Government fleet, and it is probable that the example set by them will have to be followed by others before long, which will be a big help to trade.

* * *

Vancouver.—The Coughlan Shipyards are again open after a shut-down for a couple of weeks due to a shortage of steel. The yards opened up again after the Christmas holidays and it is expected that before long there will be 1,200 men employed. The yard is building two 8,350 ton steamers for the C.G.M.M. at a cost of $1,400,000 each.

* * *

Vancouver.—The contract for finishing the two C.G.M.M. vessels under construction at Prince Rupert, which was interrupted when the Prince Rupert Drydock Co. failed to meet its obligations, has been awarded to the Wallace Shipyards, Ltd., and work will start at once.

* * *

London—Tonnage under construction in Great Britain, according to figures given by Lloyd's Register, is now greater than that under construction in the rest of the world combined. On Dec. 31st the tonnage under way in the U. K. was 3,709,000, while the world tonnage was 1,179,000 tons. The percentage of ships building in Great Britain was 51.6 per cent., while that in the U. S. had decreased to 18.2 per cent.

* * *

Montreal.—With reference to complaints that have been made in regard to the manning of the Government steamers, Mr. R. B. Teakle has issued the following statement:—"Regarding the statement that 75 per cent. of our crews should be Canadian, when crews are signed on, we must be content with the best men we can get. We doubt if it is possible to obtain the percentage of Canadian sailors and firemen mentioned in the story. Our vessels sign their crews in Canada, and our captains are not permitted to take men on in England. They are not permitted to carry passengers free."

* * *

It was officially stated the policy of the company was to make the Canadian Government Merchant Marine one hundred per cent. Canadian, and it was explained this was difficult, since the company had been in business for two years only.

* * *

It was pointed out there were forty young Canadians now in training under captains of Government vessels as cadets for the chief positions on the vessels. Mr. Teakle believes Canadian boys are quite capable of facing the North Atlantic winters.

Southampton.—A hero of the Great Lakes has passed in the death of Capt. McGregor Lambert here. For 27 years Capt. Lambert was in charge of the lighthouse at Chantry Island and during that time saved 20 lives, including the entire crew of the ship Nettie Woodward wrecked in 1899.

* * *

Ottawa.—Comparison of the cost of operation of Canadian, British, American and Japanese merchant ships of like tonnage and dimensions is made in the latest report of the Marine and Fisheries Department. According to the report, the monthly cost of wages and board on these ships is approximately as follows: British, $3,645.09; American, $6,711.10; Canadian, $2,303.50; Japanese, $1,124.50. Taking the cost of operation of the United States merchantman as 100 per cent., the British is 54 per cent., the Canadian 34 per cent., and the Japanese 17 per cent. Canadian costs are thus 20 per cent. less than the British and 66 per cent. less than those of the United States ship, but are double those of the Japanese vessel.

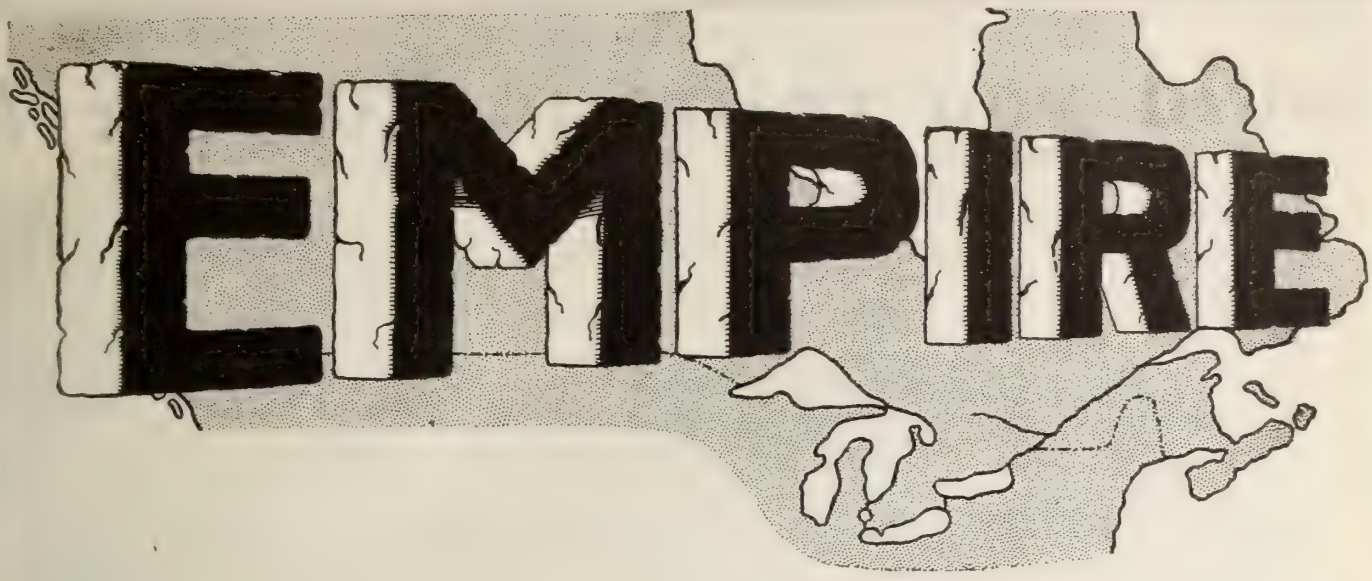
* * *

Montreal.—The Dominion Marine Association held its annual business meeting here Saturday, with delegates from Toronto, Kingston, Winnipeg and other places present. Delegates from Cleveland represented the Lake Carriers' Association.

There was a conference between the shipowners and a group of members of the Winnipeg Grain Exchange on the subject of certain changes that have been under consideration in regard to an amended bill-of-lading. Committees were appointed of representatives of each group to further discuss the drafting of a new bill of lading along the lines of the one now in vogue in the United States, and this will be considered at the meeting of the Lake Carriers' Association, to be held in Detroit Jan. 18, at which all parties will be represented.

The annual report of the association showed a membership of 26 steamship or barge companies, representing a total tonnage of 155,340, and barge tonnage of 33,920.

Among the guests attending the banquet Saturday evening in the Windsor Hotel were William Livingstone of Cleveland, Alex. Johnson of Ottawa, Capt. Scott Worten of Cleveland and Capt. E. Quackenbosch, United States Shipping Board.



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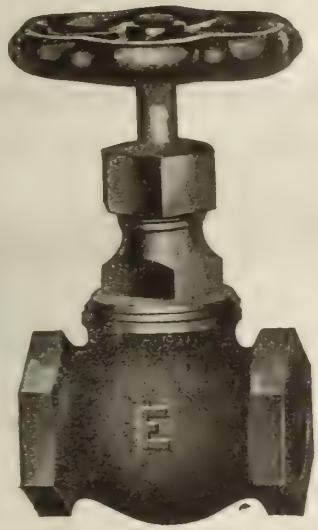

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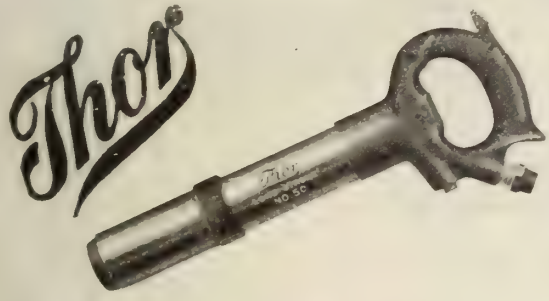

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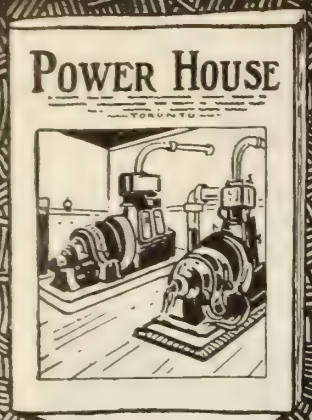

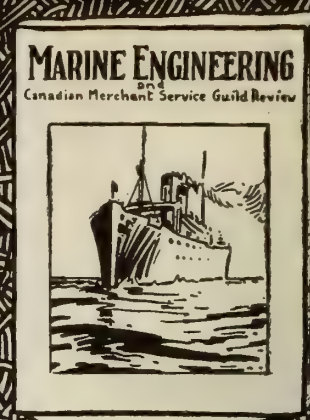

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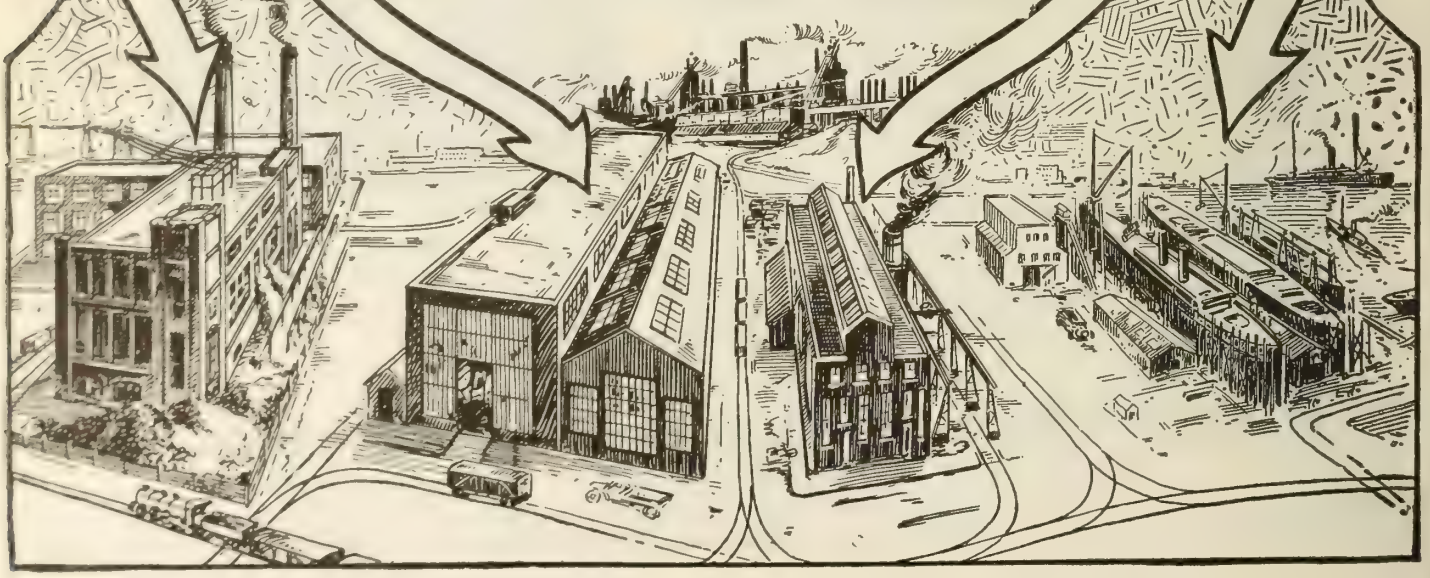

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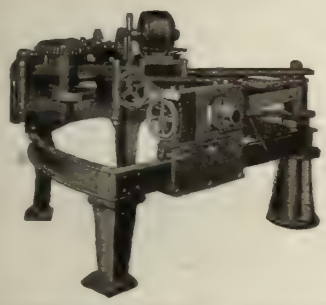

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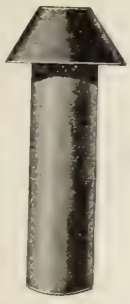

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HE adds, further: "The first aim of the Liberal party in Canada to-day is to bring about such co-operation and co-ordination of effort among men and women of liberal aims"—(a small "l" please note)—"and aspirations as will ensure defeat of the combined forces of a reactionary Government, and make possible, in matters of Government, the re-assertion and ultimate triumph of liberal" — (still a small "l")—"principles and policies."

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Other Big Features in January 15th MACLEAN'S

There are fifteen other big feature articles, serials, short fiction and regular departments. These include:

"The Human Speedometer"
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The story of a Canadian who "times" race-horses as a profession.

"The Hat" By Frederick Niven.
A vivid word-picture of a feature of our West which strikes this war correspondent.

"My Flirtation Ends"
By Mrs. "Margot" Asquith.
Wife of former Premier of Great Britain tells how her eight years' dalliance with Peter ends.

"Our Lost Immigrants" By Miss Agnes C. Laut.
She tells some cold, hard facts, and explains why hundreds of thousands left Canada

"Scarlet and Gold"
By Colonel George Ham.
Who gives here a few chapters from the romantic history of the Royal North West Mounted Police in earlier days.

"Paying the Doctor to Keep You Well"
By Ethel M. Chapman.
A worth-while and timely article, depicting the work of the Life Protective Association.

"A Canadian Child Poet"
A little bit about twelve-year-old Miss Rae Maltby Verrill, of British Columbia, whose work seems to show promising talent.

Interesting Fiction

"The Big Time Man"
By C. W. Stephens.
A bottling-business romance.

"The Act of God"
By Beatrice Heron-Maxwell.
A near-murderer's escape.

"Jane Ann's Rival, Mabel"
By Archie McKishnie.
A Lenix Ballister episode.

"The City of Peril"
By Arthur Stringer.
A romantic, Bolshevistic serial.

Review of Reviews

The Cream of the World's Literature:

"The Dreamer in the Kremlin."—H. G. Wells.

Chaplin Prey to 'Blues'."—Benjamin de [illegible]

"Which Labor Policy?"—Wm. B. Dickson.

"How Militarist is Japan?"—Quarterly Review.

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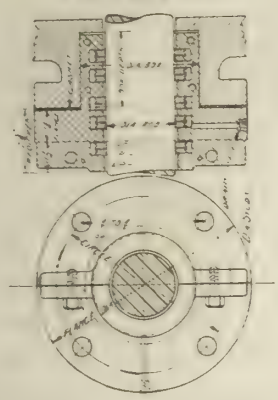

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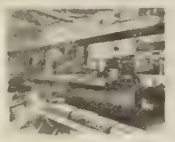

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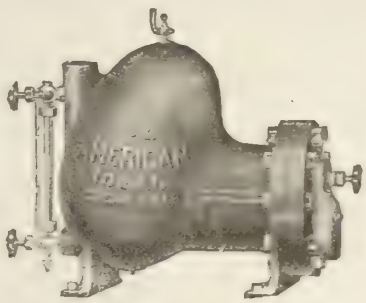

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St. Lawrence Welding Co., Montreal, Que.

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COAL HANDLING MACHINERY
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Canadian Mead-Morrison Co., Ltd., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford, Ont.

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Samuel Osborn Co.

COAL POCKETS
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COAL SCREENING PLANT
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McAvity & Sons Ltd., T., St. John, N.B.
Morrison Brass Mfg. Co., James, Toronto, Ont.

COCKS, BASIN
Mitchell Co., The Robert, Montreal, Que.

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Midland Engine Works Co., Midland, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
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Hopkins & Co., F. H., Montreal, Que.
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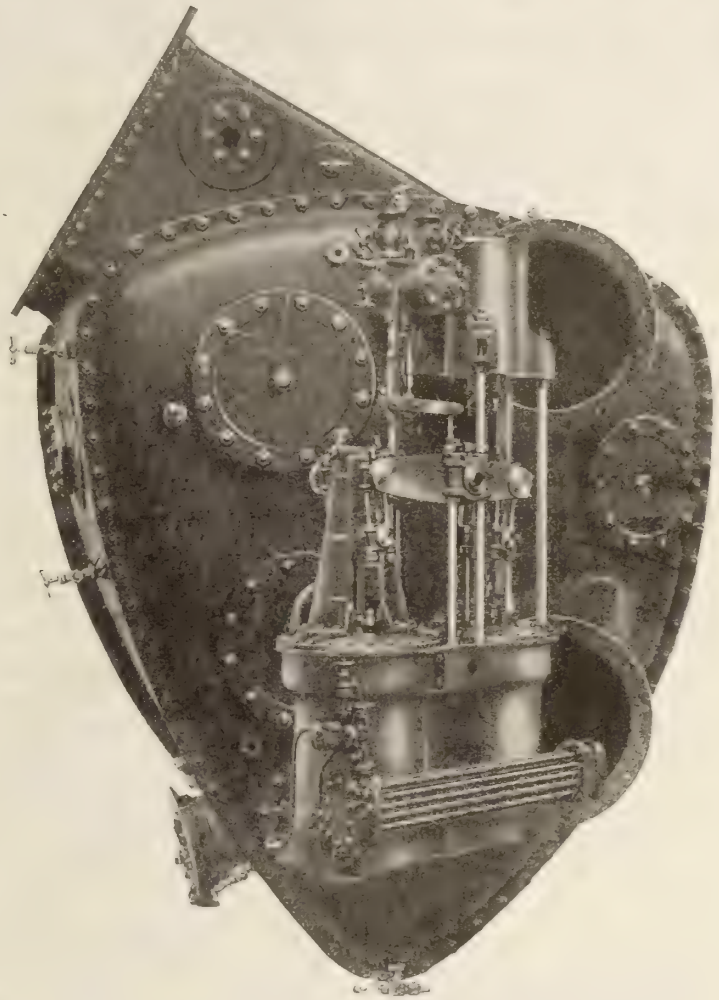

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F. H. Hopkins Co., Montreal, Que.

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Waterous Engine Works Co., Brantford, Ont.

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Quaker City Rubber Co., Philadelphia, Pa.

HOSE, SAND BLAST
Quaker City Rubber Co., Philadelphia, Pa.

HOSE, STEAM
Quaker City Rubber Co., Philadelphia, Pa.

HOSE, SUCTION
Quaker City Rubber Co., Philadelphia, Pa.

HOSE, WATER
Quaker City Rubber Co., Philadelphia, Pa.

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Morrison Brass Mfg. Co., James, Toronto, Ont.

IRON
Samuel Osborn (Canada) Ltd., Montreal.

IRON GREY
Midland Engine Works Co., Midland, Ont.

IRON AND STEEL
Mitchells Ltd., Glasgow, Scotland.

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Toronto Insurance & Vessel Agency, Toronto, Ont.

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Hopkins & Co., F. H., Montreal, Que.

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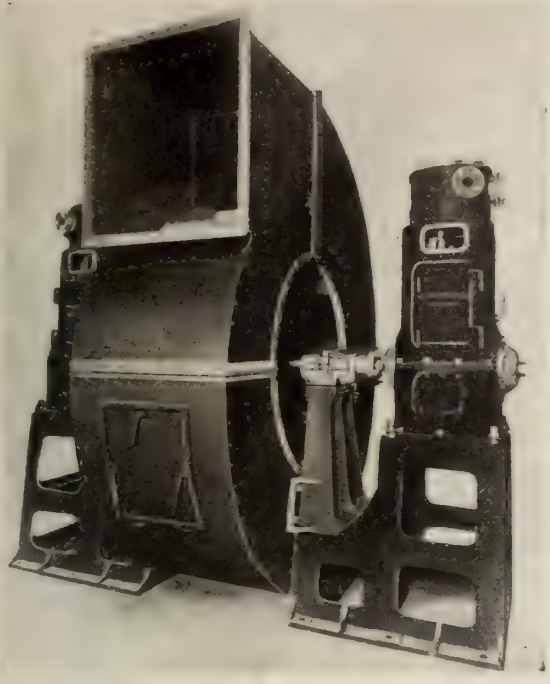

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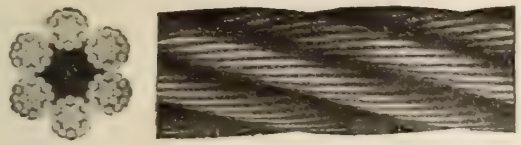

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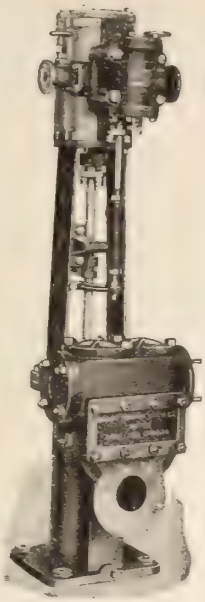

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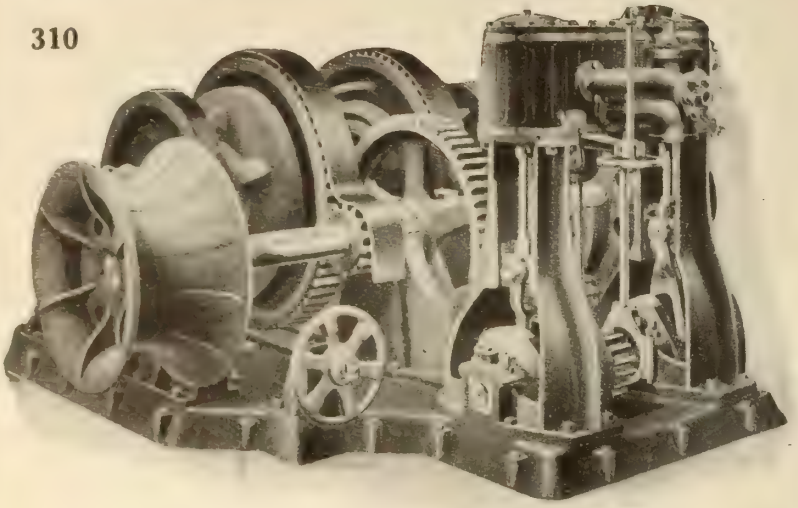

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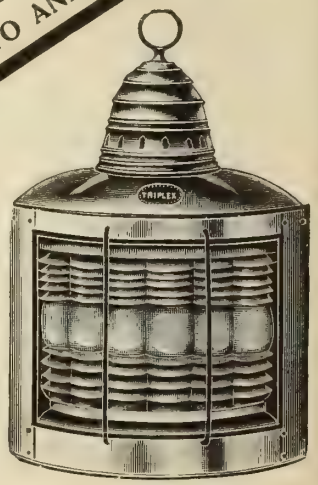

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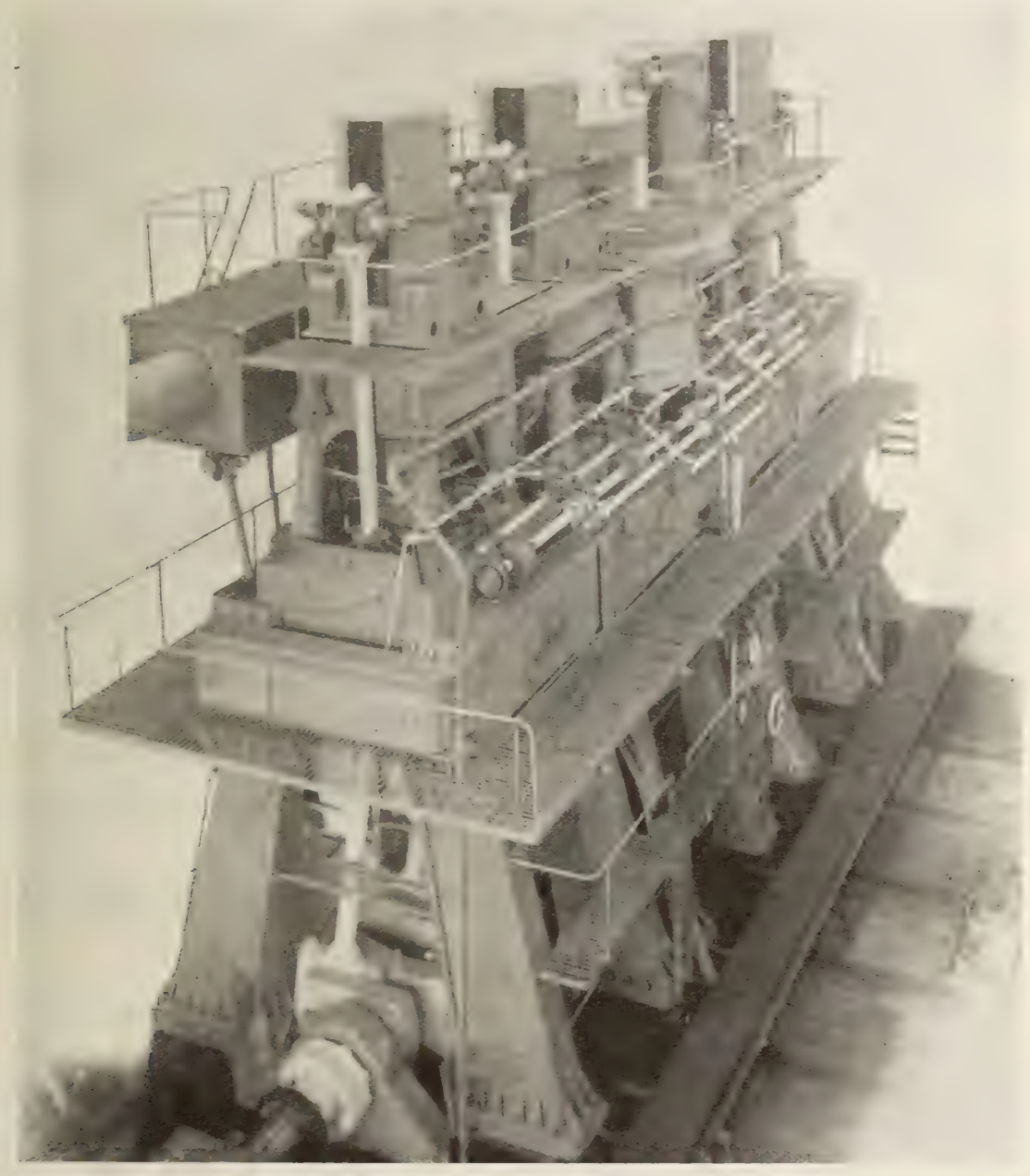

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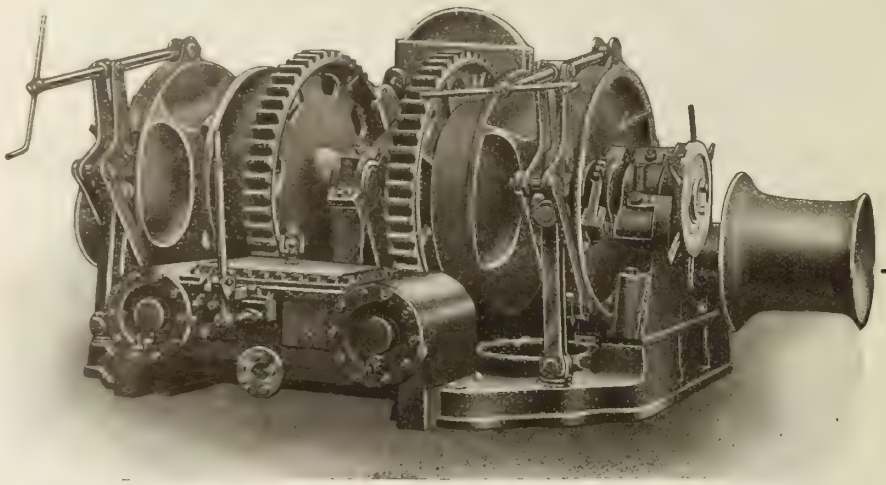

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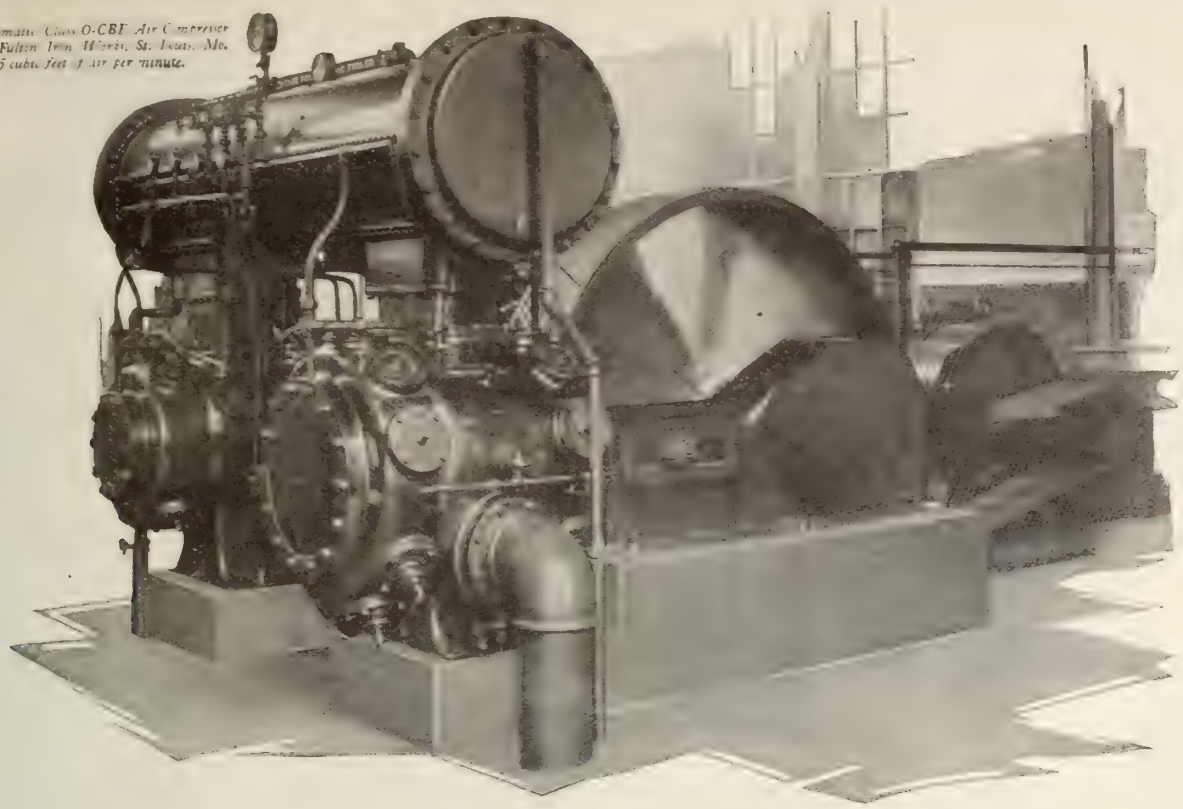

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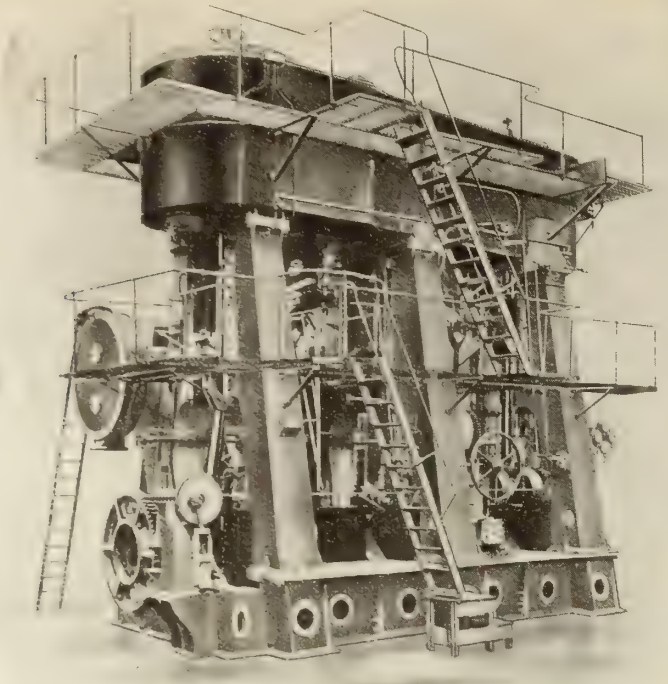

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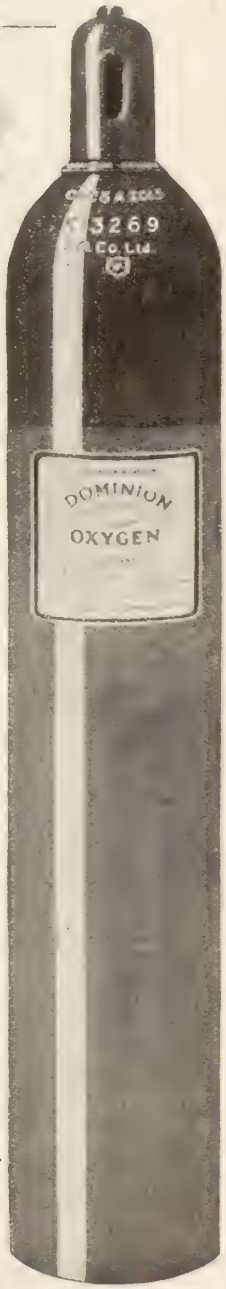

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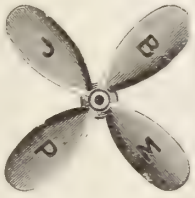

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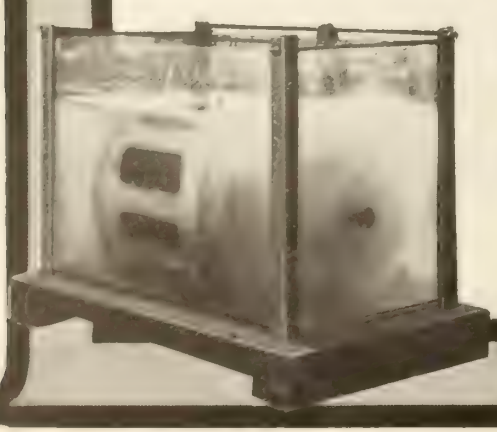

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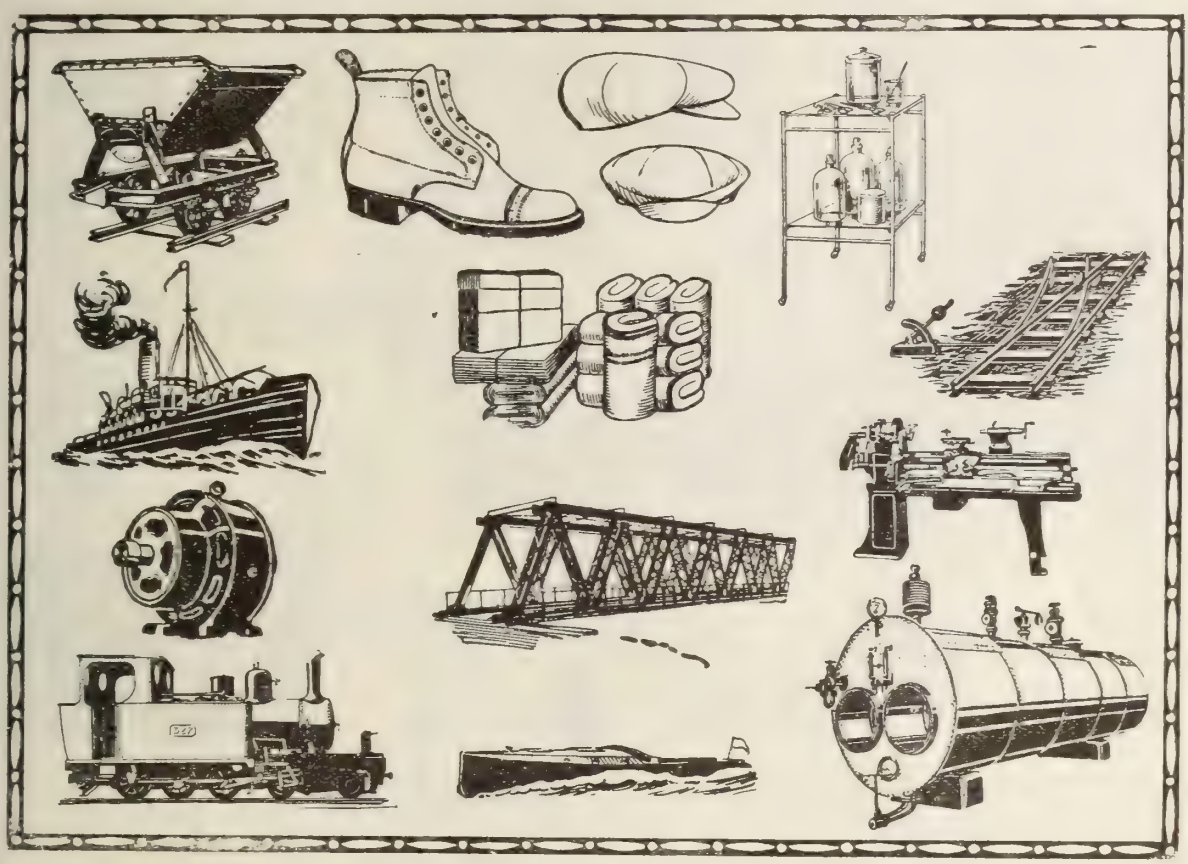

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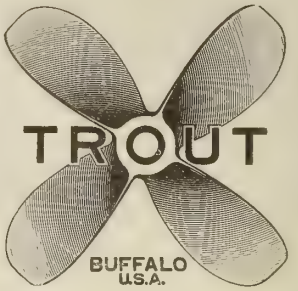

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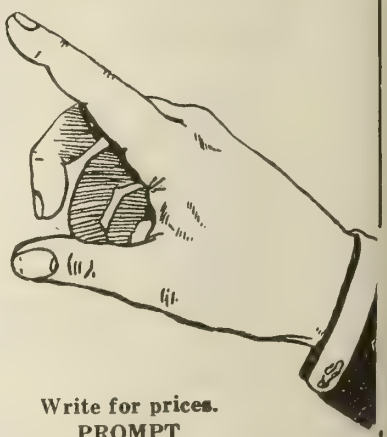

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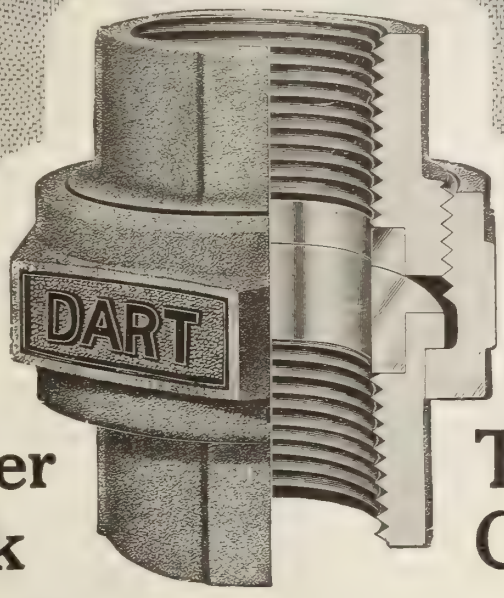

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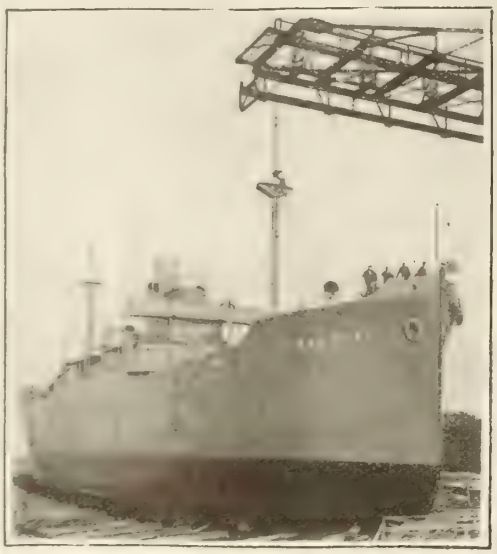

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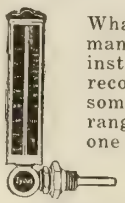

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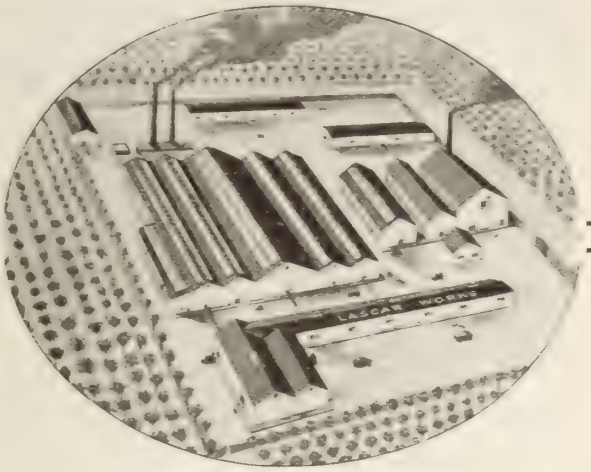

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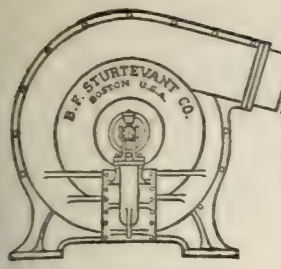

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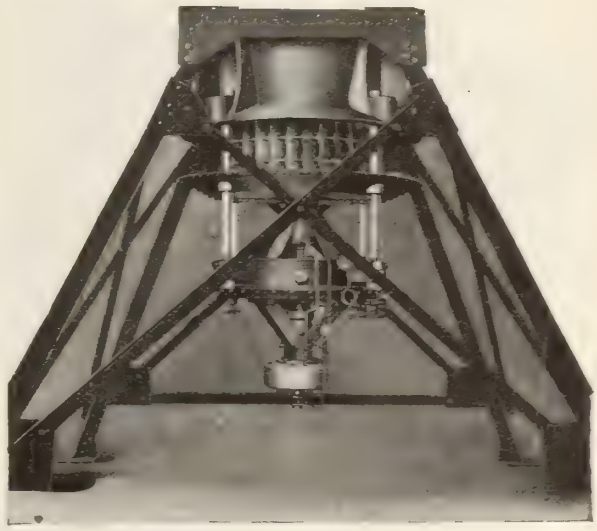

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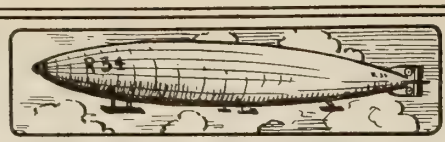

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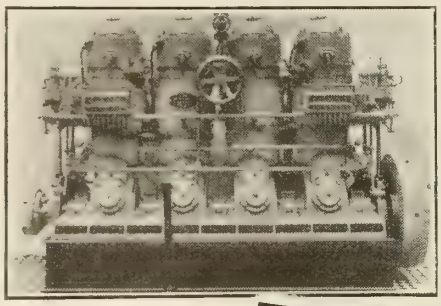

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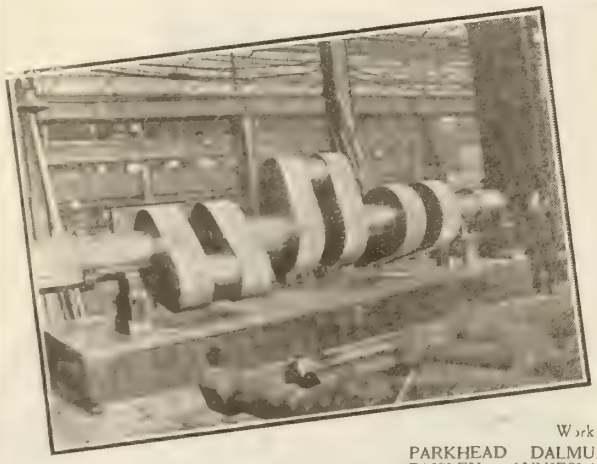

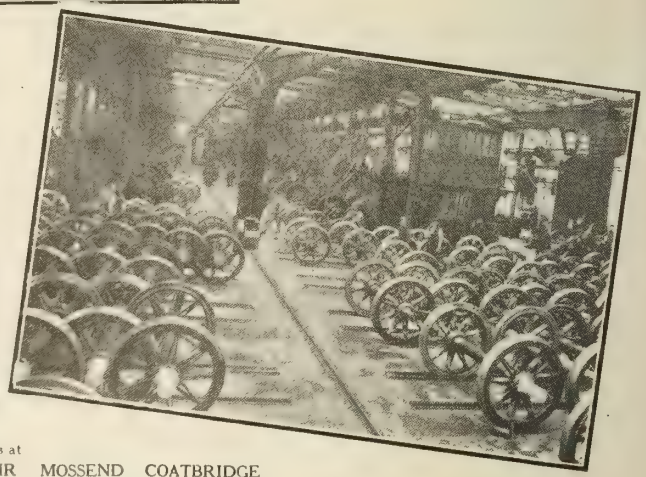

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MARINE ENGINEERING
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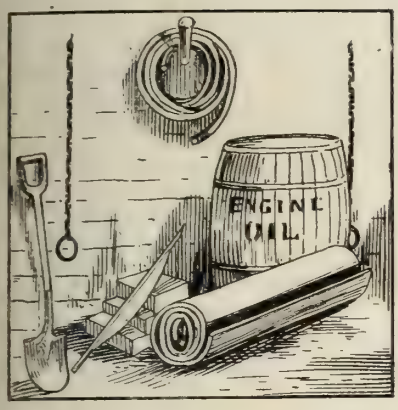


Stocking the Engine Room for a Six Months Trip

By J. H. Ferner

IF you were called on suddenly to prepare the engine room store list for a vessel to cover a voyage of six months' duration, could you sit down and do it? Unless you had been at the job very recently it is very doubtful. Even then if you had no previous store list to go by, you would probably leave something out, and discover your omission when it was too late to rectify it. The number of different things that are required can only be appreciated when an attempt is made to put them down on paper, and yet every ship's engineer should have a knowledge of this most important matter. It is, in fact, sometimes put as a question in the Board of Trade examination in Great Britain, and usually in the highest grade, showing what importance they attach to the ability of the candidate to properly perform the task.

The superintendent engineer of a line of steamships has also to have a very close acquaintance with the requirements of the ships under his charge, and generally does, he having as a rule been a seagoing engineer himself. Everybody from the second engineer, who usually makes out the requisition, the chief engineer who checks it, the superintendent engineer who cuts it down, and the purchasing agent who secures the supplies in the best market (or is supposed to) is vitally interested in the store list. Of course, in the case of the larger lines, there is usually a large stock of stores on hand in the company's own warehouse, and supplies are bought in such quantities that good prices are assured. Even in this case, however, the superintendent engineer keeps a jealous eye on the store list, and keeps the requisitions within bounds. There are very few engineers who err on the side of carefulness in ordering stores, because they feel that they are likely to be cut anyway, and therefore allow a certain percentage for the super's blue pencil. It is not much of course for a second engineer to ask for a bit extra on this or that particular item, but when it is multiplied by a number of ships and a number of voyages in a year, it brings operating costs up quite a lot.

Making Out the List

The first thing to consider in the way of stores is lubricating oil. Fuel can hardly be included in the list of stores, and as a matter of fact is not so included, but is arranged for by the head office direct. The nature of the charter and the loading port decided upon, have a direct bearing on the coal supplied, its quantity and quality. Therefore this matter is out of the hands of the ship's staff to a large extent. The chief engineer of course will be expected to give accurate information on his requirements for the particular voyage in view, but the final decision will be made by the management, who will take into consideration the numerous factors which influence the success or failure of a voyage.

Most ships of the general cargo carrying or tramp class have a limited amount of storage room for oil, but this is quite sufficient for their requirements over the usual lengths of voyages. Oil is stored in tanks in the engine room, and very often the columns supporting the cylinders are used as storage for engine oil. When tanks are used they are usually situated on a stringer in the engine room, and pipes are led down from the main deck to each tank. The barrels are emptied into these pipes as they come aboard. In case there is not enough room in the tanks to hold the oil required, some barrels will have to be carried till there is room to put their contents in the tank. In this case it is up to the second engineer to make sure that they are properly secured against rolling and breakage. I remember a case of this kind where the oil barrels were not placed as securely as they were thought to be. The oil in this case was paraffin or coal oil, and was to be used for illuminating purposes, the ship having no electric light. We were bound for Japan in the first instance and after that the destination was indefinite, and as coal oil has to be purchased out East in cases it is expensive. Therefore an extra quantity was taken aboard in the home port. The coal oil tank was filled and two barrels still remained. The store room was filled up to a sufficient degree and it was not advisable to store barrels of highly inflammable oil down below, so the barrels were lashed securely on the after main deck. They were lashed up against the bulwarks, each barrel between the bulwark stanchions, and were pronounced safe by all the experts. About eight hours out of port we ran into a heavy gale of wind with a rapidly rising sea, and this continued through the night with gradually increasing force. When the second came out of his room at eight bells in the second watch, he was struck by a strong smell of paraffin. Surmising something had gone wrong with the barrels stowed on deck, he started hastily down the ladder from the bridge deck to the after deck, and in his hurry took the weather side. For this he was nearly washed overboard, and when he got back his breath and shook the water from his eyes, he perceived in the dim light the two precious barrels washing around the after deck, and from the way they rode, knew they were empty. However, with the help of one of the deck crowd, he got hold of them and confirmed his suspicions and then went to examine the lashings, which were found to be perfectly intact. The barrels must have been washed out

of the lashings bodily, and then broke open by hitting things as they rolled around. The result was that the rest of that voyage was spent in semi-darkness down below, as no one wanted to buy more oil and explain the circumstances to the super afterwards. This little incident shows the advisability of not carrying any more oil than can be got into the tanks, when it can be avoided.

How much of each kind of oil, engine, cylinder, colza, and coal oil, will be needed? We will suppose we have a vessel of about 1,500 I.H.P. and that she is going to be away for about six months. Now for a ship of that size there will be allowed about one-half gallon of lubricating oil per watch while under way, which is three gallons per day. The siphon boxes on the main bearings, etc., have to be filled when leaving port, and the thrust block will require about ten gallons of oil for itself when first getting under way. Suppose that the voyage is going to comprise about 150 steaming days out of the 180. That means that there will be required about 450 gallons of oil while under way. For purposes of siphon boxes, thrust block, eventualities such as bearings warming up, another 100 gallons should be carried, which makes 550 gallons. There should always be some oil on hand when arriving home. Of course, some jobs require more oil than others, but the necessary amount per watch is usually determined on the first voyage, and that amount has to be rigidly adhered to. One good thing about this is that it makes every drop of oil count, and allows for no waste. The careful engineer will take advantage of good conditions, such as cool weather, to save some of his allowance, which helps to build up a reserve against emergencies, and as a rule each engineer tries to see how little oil he can get along on without anything warming up.

Cylinder oil is expensive, and if it gets through the condenser into the boilers is dangerous, and therefore its use is kept down to a minimum in the average ship. The only cylinder oil used in many ships is that which is used to swab the rods, and a little placed in the cylinders of auxiliaries occasionally. For a vessel such as we are speaking of, the allowance per watch would be about half a pint, or say one quart per day. That would mean for the voyage say thirty gallons, and for eventualities another ten gallons, say forty gallons, or about one barrel. If there had been no cylinder oil at all left on hand from the last voyage it would be better to take another half barrel, to be sure of some reserve. The quantity of illuminating oil required these days is very small, as practically every ship has electric light. This is a change from the days when the writer went to sea, when the number of ships of the tramp class carrying a dynamo was strictly limited. However, a certain amount of colza oil will be needed for hand lamps and some coal oil for general purposes such as cleaning, etc. In a ship with duplicate

1361 CANADIAN GOVERNMENT MERCHANT MARINE, LIMITED

S.S. _____

ENGINEER'S STORE DEMAND

_____ ___19 For Voyage No.

NAME OF ARTICLE		Expended last Voyage	Remains on Arrival	Required for next Voyage	Approved	Remarks on last Supplies, Dimensions, &c., of Present Demand
Brushes, Varnish	No.					
" Bannister	"					
" Flue Wire	"					
" Paint	"					
" Scrubbing	"					
" Swabbing	"					
" Whitewash	"					
Brooms, Coir	"					
Mats, Engine Room	"					
Zinc Plates	"					
Note Paper	quires					
Foolscap	"					
Blotting Paper	"					
Envelopes	packets					
REFRIGERATOR						
Packing	ft.					
Gland Leathers	No.					
Piston "	"					
Sheet Leather	butts					
Ammonia Gas	botts.					
CO_2	"					
Chloride of Calcium	cwt.					
Thermometers (Chilled Meat)	No.					
" (Frozen ")						
" (Brine)						
HYDRAULIC						
I.R. Discharge Valves	No.					
" Suction "	"					
Insertion	ft.					
Greasy Flax	"					
Cup Leathers	No.					
Rings for Pump Bucket	"					

dynamos there is probably never any call for oil for lighting purposes, but where there is only one dynamo there will be occasions when the humble oil lamp will be called into play. The amount of these oils required will have to be determined from individual conditions, and it is impossible to lay down any even approximate amount to cover all cases.

Having covered the oil requirements, the next thing to think about will be the various articles of merchandise required for maintenance purposes. These fall under the head of packings, jointing materials, sheet metal of various kinds, paints, and spare parts for engines and boilers.

The Packing List

There will be a considerable amount of packing required, of various sizes and materials. Starting first with the piston rod glands, and at the high pressure end, estimate what will be required to carry over the voyage. The piston rods will probably be in the neighborhood of six inches in diameter, and the stuffing boxes 8 to 12 inches deep and ⅞ inch to 1⅛ inches wide. The high pressure rod gland will in some cases be packed with metallic packing, though this is not universal by any means. If asbestos packing is used it will need to be of a very high grade, for the high pressure rod, and there are several brands made which have a very wide use. The high pressure gland will take about eight turns of packing, and as the diameter is 6 inches each turn will be about 18 inches long. This means 12 feet of packing to completely pack the gland. There should always be enough packing on hand to allow for a complete repacking, and the amount to be ordered will depend on the date of the last packing of the gland. If this has occurred fairly recently, it may well be that the gland with the addition of one or two new turns will carry the ship on her outward voyage.

CANADIAN GOVERNMENT MERCHANT MARINE, LIMITED

S.S._____

ENGINEER'S STORE DEMAND

_____ 19 For Voyage No. _____

NAME OF ARTICLE	Expended last Voyage	Remains on Arrival	Required for next Voyage	Approved	Remarks on last Supplies. Dimensions, &c., of Present Demand
ELECTRIC LIGHT					
Bases for Lamp Holders No.					
Bridges for Fuses "					
Brass Caps for Fuses					
Chatterton's Composition sticks					
Commutator Brushes (Copper) No.					
" " (Carbon) "					
Fuse Fittings "					
Globes, Frosted "					
Hemispheres "					
India Rubber, Strip lbs.					
Insulators No.					
Lamp Holders "					
Lamps "					
Shades, Clear Glass "					
Switches, Section "					
" Single "					
Tape, Black lbs.					
Tape Rubber "					
Tape & Rods for Switches, Earthenware No.					
Wire, Main ft.					
" Single "					
" Flexible "					
Solder lbs.					
Resin "					
MISCELLANEOUS					

FACSIMILE OF REQUISITION SHEET.

The gland will then be completely repacked in the foreign port, and should then be able to carry the vessel home without another packing. This means that enough packing of this kind for one complete packing will be required, and as there should always be that much in reserve, also allowing for the two new turns put in, about 30 feet will be required. For the intermediate gland a cheaper grade of packing can be used, and about the same quantity should be carried, while for the low pressure gland a packing is required which can stand a certain amount of moisture, and being exposed to more condensation and perhaps greater temperature changes it is often a fact that the low pressure gland has to be packed more frequently than the others. It is the practice in a good many ships to take the packing from the intermediate gland, that is, the lower turns, and use them over again in the low pressure. In this case as in the others, judgment must be used, but there should be enough packing in stock to allow the gland to be completely repacked at least once on the voyage, and have enough remaining to again fill it completely if needed. It may be said that it is usual to accumulate a little reserve over and above these quantities, but this amount can be ordered without fear of any cutting down.

Following the main glands, the valve spindles have to be taken care of. In this case, the high pressure valve spindle packing is usually only exposed to the pressure and temperature of the intermediate steam, as the exhaust takes place over the ends of the piston valve instead of through the centre, as with the slide valve. Therefore the same grade of packing will do for both these spindles, and often one grade is used for the three. This packing will be about ¾ inch, and the rods will be 3 to 3½ inches diameter, and the stuffing boxes hold about 5 turns. Therefore it will take 15 turns of packing, each about 10 inches long to fill the glands, or about 15 feet. There should then be about 30 feet in stock, and sufficient must be ordered to bring up the stock that amount.

For the various auxiliaries, such as the dynamo engine, feed pumps, ballast pumps, general service pumps, fan engines, circulating and air pumps and bilge pumps, both asbestos and flax packing will be required. The amount of this must be determined from the number of glands and their sizes and can be estimated in the same way as the packing for the main engine glands. If the air pump is of the type packed with hemp rope, enough of this material must be ordered to take care of the repacking of the air pump bucket if required. As a general rule, three grades of packing will be required for the auxiliaries, that is, asbestos packing for the steam ends, flax packing for the water ends of pumps handling cold water, and special hot-water packing for the feed pumps and air pump. Small packing such as the metallic strip, or twist asbestos for packing valve stems must be included in the packing list. Last but not least of the strictly gland packings comes the flax packing for the stern gland, one of the most important or perhaps the most important in the ship. Now in the nature of things but little of this packing will be required, as it is only when the vessel is in dry dock that this gland can be packed, but occasionally a turn can be put in when the vessel is light, if care is taken in the job. The gland is slacked back just far enough to enter the turn, without being taken off the studs, and the gland screwed hard up. If it enters far enough for the admission of another turn it is slacked back again and the second turn entered. However, this is an unusual thing, and it is usually only when the ship is in dry dock for an overhaul that this gland is packed.

We have then so far got on our list the lubricating oil, cylinder oil, colza oil, paraffin oil, asbestos packing of various sizes, flax and hemp packing, and small packing for the various small glands around the vessel.

The cylinder cover joints and the manhole door joints of the boilers are usually made on board ship of asbestos tape, about one inch wide, and one-eighth of an inch thick. Cylinder cover joints if properly made usually last through two or three overhauls, but like everything else require renewing occasionally. Boiler door joints are sometimes used, but it is usually better to renew the joint than to take a chance of having to empty the boiler after filling due to a leaky joint. This asbestos tape is usually supplied in coils containing 25, 50 or 100 feet and it is such a useful thing that it is always well to have a spare 50 foot coil on hand, besides the coil that is in use. For pipe joints various kinds of material are used, according to the fancy of the chief, but generally for permanent steam joints either gauze wire sewn with lead wire, or asbestos cloth, is used. This asbestos cloth may be wire woven or plain, but for steam joints the wire woven kind is preferred.

There will also be red rubber for water tight joints, and where this is used on high pressure lines it will also be wire woven. Here then is another or rather several other items for our list, and we may say that there will be required two square yards wire gauze, 2 square yards wire woven asbestos insertion, 2 square yards wire wove red rubber insertion, and one square yard of asbestos paper. This latter is sometimes handy in making small joints. Asbestos millboard is sometimes carried and I have known it to be successful in making a joint when everything else failed. For using with the

gauze wire jointing lead wire will be necessary, and as this is also used for another purpose, taking leads off bearings, we shall want two sizes of this. Therefore the order should be for one pound of 1-16 and one-half pound of 1-32 lead wire. This is not fuse wire but lead wire. We shall order the fuse wire with the electrical stores.

Speaking of joints brings us to the question of nuts, bolts, and washers and the stock of these useful articles must be kept up. Generally speaking, it will be found that the sizes you don't particularly need will be in plentiful numbers, while that size that you want in a hurry will be found only by pawing over the other sizes. This should not be so, but very often is. All sizes of nuts and bolts from ¼ inch to 1 inch and of various lengths should be kept in the store room, and washers to fit. The lengths and sizes will be governed by the predominating pipe sizes, and there should be an endeavor to keep at least a couple of dozen of each size on hand. As a matter of fact, this seems to be a difficult thing to do, and as we remarked, there are usually large numbers of one kind and a dearth of others. Naturally the sizes most in demand will be ½, ⅝ and ¾, and these at least ought to be plentiful.

Closely connected with these latter things, will be bars of round iron to make studs or bolts from in case of necessity. It is usual to carry a few feet of round bars in ½, ⅝ and ¾ inch sizes and also the same sizes in round brass rods. Sometimes a bar of chisel steel will be found aboard, but this is not usual.

For general purposes we must have a sheet of ⅛ and a sheet of ¼ inch black iron, and a very useful material which no engine room should be without is Muntz metal, sheets of which in 1-16, ⅛ and ¼ inch sizes should be included in the list. There should also be some 1-32 metal for making liners, and for this purpose as well as for repairing lamps and oil can, a few sheets of tin will be required.

Tin makes us think of solder, and five or ten pounds of this should go down in the list. Muriatic acid will be needed, and perhaps a new copper soldering bolt may be necessary. Usually the ones sent out with the ship survive for a long time. Some of the lamps and oil cans will be too far gone to repair, so it will very likely be necessary to order half a dozen oil feeders and the same number of duck lamps.

We have thus got the necessary oil to keep the engines going, the oil cans to feed it with, illuminating oil to light up the dark places, if needed, and coal oil for cleaning and illuminating purposes. In order to make the various joints we have the different jointing materials, and we have all kinds of packing to fill the different glands in the engine room and on the winches on deck. We have also seen to the fact that there will be bolts to make the connections between the flanges when we have to make the joints. The asbestos tape is on hand to make cylinder cover joints, evaporator door joints, feed heater cover joints, and manhole door joints.

There are a certain number of joints such as condenser doors, pump valve chamber covers, and so on, which can be made very handily with flat lamp wick, of which there will have to be a certain amount on hand, even where there is a dynamo installed. The small twist packing for valve spindles can also be used for quite a few joints, and the lead wire can be used also for certain places, particularly on small cylinder covers, etc.

For the siphon boxes on main bearings, etc., it will be necessary to order a couple of balls of white worsted. Speaking of main bearings makes us think of the tunnel shafting, and we shall need about 100 pounds of solidified oil or grease for these bearings, which we nearly forgot when ordering the lubricating oil. These little things are apt to slip one's mind, even when one is right on the job.

Some Spare Gear

Going round to the back platform where the auxiliaries sit, we are reminded that we must have a certain amount of spare gear which is sure to be called for during the voyage. This includes rubber valves for the circulating pump, Kinghorn valves for the air pump, rubber valves for the ballast donkeys, and at least one set of suction and delivery valves for the main feed pumps, when these are independent of the main engines. Even if they are of the type worked off the main engines it is well to have a spare valve or two, for sometimes even these heavy brass valves break. Pumps which have special brass studs with hexagonal cup heads and springs on the suction and delivery valves, will require a few of these on hand to make up for breakages. There should be enough of these studs and springs to completely renew the suction and discharge chambers if necessary. Pumps may run along quite a while without much replacement, and then suddenly take a notion to break springs and valves every time they are started up. There is not much use in going into the causes of these things here, but they may be put down to what Kipling has called the "cussedness of inanimate objects."

Some of the pumps will have the water pistons packed with fibre packing, and when this is the case, this material must be put in the store list. It is well to have some spare piston rings for the steam ends of the various auxiliaries, and where the feed pumps have water pistons packed with ebonite rings, there should be one set at least to spare. Spare gear in the shape of piston rings for the winches must be on hand, and it is usual to have one or two sets of top and bottom end brasses and eccentric straps for these long suffering and badly abused machines. The wise engineer will, in fact, try to collect as much spare gear for the winches as he can lay hands upon, for if there is one thing in the ship that is sure to need it, it will be a winch. I have seen the main crank shaft bearings of a winch held in place by strong wooden struts jammed in between the combing of the hatch and the bearing cap for lack of the necessary stock to make bearing studs of. There is nothing in a winch outside of the main frame that isn't likely to carry away at some time, and it is well to be prepared. There is usually a fair amount of spare gear put in the ship when she is new, and it should be kept up to its original amount at least as far as deck machinery is concerned. After this brief excursion on deck, let us return below, for we have by no means finished down there.

If a vessel is fitted with forced draught and there is only one fan engine, there should be a spare connecting rod complete, and a spare eccentric strap on hand. Spare gear for the main engines is, of course, a matter of compulsion and we do not need to bother about that.

We have pretty well covered the material necessary for the running maintenance of the engine room, and should consider what we will require to keep up its appearance.

First of all, we must have waste, both for wiping down and for hand use.

Coarse colored waste will be needed for the rough work, and fine white waste for finishing up. The super or the management may object to furnishing the fine waste and give a grade that is not quite as coarse as the colored waste but a long way short of the best white waste. There should be two bales of coarse waste and one of fine waste. There must be plenty of soft soap aboard, both for washing paint work down below and for washing out the firemen's quarters. There is usually about 100 to 200 pounds of soft soap carried, according to the number of the crew and length of voyage. Sal soda for the boilers, and also for washing paint work in conjunction with the soft soap, when it is known as soojee-moojee, must be carried, and it is usual to have a barrel of this ordered. It is, of course, put into an iron tank after it comes aboard, otherwise it would be lost. A small amount of caustic soda should be carried, say about ten pounds, but the use of this is of necessity very sparing.

To keep the bilges clean and sweet some disinfecting fluid must be carried, and here again the choice will largely lie in the hands of the shore staff. There are many excellent preparations for fulfilling this purpose, but an effort should always be made to get plenty of it, and use it. If the voyage is a tropical one, it will add vastly to the comfort of the watch in the engine room. There are many engine rooms which look clean and pretty above the platform, though if a peep were taken in the bilges, a different impression would be gathered.

Every ship is a great user of paint,

and the engine room require their share. First of all, there will be red lead, which is the great preservative for steel work, against the ravages of corrosion. This is bought in its powdered state and mixed as required. There should be at least 300 pounds of this useful powder, as it is used for painting, mixing putty and various odd jobs around. Following that will be white lead, of which a small amount may be enough. For painting purposes white zinc is used when it can be obtained, and when this is the case, about 100 pounds of white zinc and 150 pounds white lead should be carried. A small can of Prussian blue, about ten pounds, is required for mixing in the white zinc to prevent it going yellow. There will be about ten gallons boiled oil, and a couple of gallons of turps. If the second has artistic tastes he may require a small amount of vermilion to pick out the spokes of the hand wheels, in approved Geordie tramp style. (A Geordie tramp is a tramp steamer hailing from the Tyneside district in England.)

The scheme of decoration of the engine columns and condenser may be stone color or engine green or French gray, and the necessary paint must be ordered to give this freshening up. It may be that the paint has been carefully varnished from time to time, and in this case it will only require a washing and another coat of varnish. About a gallon of copal varnish will do all that is necessary for the voyage. There is little need for patent driers in the engine room paint, as the temperature does the drying fairly rapidly. It might not be out of place to mention here that where paint is to be used on hot surfaces like the boiler lagging, or boiler room bulkhead, under cylinder covers and on condenser, it is best to mix it with paraffin oil instead of boiled oil, and this prevents it blistering. It also keeps its color better. White zinc mixed with paraffin is used inside the boilers also.

There are a few odds and ends for the engine room besides all these mentioned. There should be, for instance, a bolt or half a bolt of No. 1 duck canvas. A skein of sewing twine is necessary, and a couple of hanks of spun yarn. Two or three balls of marline are required, and this is used for stringing nuts on during an overhaul, holding up brasses, etc., and for making grummits. The sewing twine is used for making grummits, fishing wicks through duck lamps, sewing canvas or filter cloths and a number of other things as they occur. There must be some spare shafts for the flogging hammer, a couple for big Monday, and a few hand hammer shafts. There must be from 100 to 200 pounds of babbitt metal aboard for renewing bearings if required, or for other emergencies. I remember a case of a piston rod gland on a donkey pump breaking and being replaced by a babbitt gland made aboard ship, which stood for many a long day after. Don't forget brooms, brushes and mats, also some bathbrick. Eye bolts, shackles and chainslings are of course included in the outfitting and hardly come under the head of stores.

The Boiler Room

There are certain supplies which must be ordered for the boiler room, especially as apart from the engine room. These include such things as fire clay, fire brick, cheek plates for furnaces, fire bars, firing tools, wheelbarrows, coal measures, coal baskets, gauge glasses, a most important item, zinc slabs or plates, tube brushes, ash bags and ash buckets, brooms. Boilers have to be cleaned, so you will require chipping hammers, scrapers, etc. There is another thing without which no real fireman can be happy, and that is what is known officially as a sponge cloth, but technically as a sweat rag. This highly useful article comprises in itself a handkerchief, a muffler, and a protector during the watch from heat, and at the end of the watch is used as a body flannel and wrung out as a towel. The second must be sure to have enough of these to enable him to issue one a month at least to all his crew, or he will hear distinct and uncompromising dissatisfaction. A fireman may have no clothes, but he must have his sweat rags. These sweat rags also are worn in different styles, by which one can tell the home port of the wearer. If he wears it loosely round his neck with one end in his mouth he is from Liverpool, while if he wears it with a knot at one side he is from the Tyne. A curious piece of psychology.

Conclusion

The writer has here endeavored to give information that would help a young engineer to make a stab at making up a store requisition. The old timers do not need any help, and of course if a man has a printed list to go by he will not forget much. On the other hand, let anyone sit down without any guide in front of him and try to make out a store list to cover all requirements and see how many things he will miss. For instance, in this article it has just occurred to the writer that he never thought of ordering any paint brushes. The facsimiles of lists reproduced in part here give some of the other items such as electrical supplies which must be carried. When one considers the requirements of one ship and then thinks of the number of ships clearing every day from home ports, what a vast amount of merchandise fills the vision. It gives one almost the same feeling of awe that we felt when introduced to the bottom platform of our first job at sea. I said almost. There is no feeling quite approaches that.

LLOYD'S REGISTER SHIPBUILDING RETURNS

For the Quarter ended December 31, 1920

WE publish to-day Lloyd's Register shipbuilding returns for the quarter ended Dec. 31, 1920. One of the outstanding facts is that the merchant tonnage building in the United Kingdom at the end of December, 1920, viz., 3,708,916 tons, although considerably more than the work which was in hand twelve months ago, shows a decrease as compared with September, 1920. It should be noted that warships are not included in these returns, and that as complete totals for Germany are not yet available, no figures are shown for that country.

This is the first time, since the end of the war, that a decrease is shown as compared with the previous quarter's returns. The tonnage building at the end of December, 1918, was close on 2,000,000 tons; at the end of December, 1919, it had increased by over 1,000,000 tons, and at the end of September, 1920, the figures had reached 3,731,098 tons. The present decrease is a small one, viz., 22,000 tons, but it may prove to be the beginning of a decline just as rapid as the increase which has taken place since 1918. This possibility is emphasized by the fact that the total tonnage of vessels commenced during the quarter, viz., 506,353 tons, is 139,000 tons below the average of the previous six quarters.

One fact of great importance, which a comparison of the Shipbuilding Returns discloses, is that although the total tonnage under construction has been, and is still so large, the amount completed has compared very unfavorably with that of pre-war times. In 1913 the average tonnage completed during each quarter was over 23 per cent. of the total work in hand at the beginning of the quarter; whereas in 1920 the corresponding figures do not reach 13 per cent.

In this connection it is interesting to find that the tonnage launched during the last quarter of 1920, amounting to about 580,000 tons, is the highest output for any quarter, being 12,000 tons more than the previous record figures for the fourth quarter of 1913. The tonnage building in the Glasgow district, viz., 959,347 tons, is a record.

The total merchant tonnage building abroad, 3,470,862 tons, is about 363,000 tons lower than the total building at the end of September; this is entirely due to the large decrease in the tonnage building in the United States—462,000 tons less than at the end of September. An enormous decrease has taken place in the tonnage under construction in the United States during the last two years. At the end of March, 1919, 4,185,523 tons were actually building in that country, which total by the end of December, 1920, had been reduced by nearly 69 per cent.

Apart from the United States, there has been an increase of tonnage building abroad during the last three months of nearly 100,000 tons. The leading countries are Holland with 450,964 tons, France with 397,969 tons, and Italy with 363,784 tons under construction.

The world's total—7,179,778 tons—is about 385,000 tons lower than the figures for September and 869,000 tons lower than the "record" figures reached at the end of September, 1919.

A notable feature of the returns is the number of tankers under construction in the world. The returns show that there are at the present time 169 steamers and motor vessels, each of over 1,000 tons, with a total tonnage of 1,169,003 tons building for the carriage of oil in bulk. Of the total, 64 of 422,553 tons are building in the United Kingdom and 88 of 637,100 tons in the United States. For the first time the returns distinguish between steamers and motor vessels. At the end of December there were under construction in the world 189 vessels of 454,502 tons to be fitted with internal combustion engines.

The tonnage of vessels actually building under the supervision of the Society's surveyors, and intended to be classed with Lloyd's Register, amounts to 4,800,409 tons, viz., 2,920,656 tons in the United Kingdom and 1,879,753 tons abroad.

The following figures showing the merchant tonnage building in the world at the end of June, 1914, may be of interest for comparison with the present totals:

Building in the United Kingdom.....	1,722,124 tons.
Building abroad	1,440,766 tons.
Total for the world	3,162,890 tons.

MERCHANT VESSELS UNDER CONSTRUCTION

The returns compiled by Lloyd's Register of Shipping, which only take into account vessels of 100 tons gross and upwards the construction of which has actually been commenced, show that there were 921 merchant vessels of 3,708,916 tons gross under construction in the United Kingdom at the close of the quarter ended Dec. 31, 1920. The particulars of the vessels in question are as follows, similar details being given for the preceding quarter, for the purpose of comparison:

Description	Dec. 31, 1920. No.	Gross tons	Sept. 30, 1920. No.	Gross tons
Steam.				
Steel	822	3,470,932	865	3,510,742
Ferro-Concrete .	2	1,494	3	1,754
Wood and comp.	5	2,429	3	1,979
Total	829	2,474,855	871	3,514,475
Motor—				
Steel	54	225,960	47	204,911
Ferro-Concrete .	2	600	2	600
Wood and comp.	1	450	1	150
Total	57	227,010	50	205,661
Sail—				
Steel	35	7,051	38	10,620
Ferro-Concrete .	..	....	..	....
Wood and comp.	..	....	2	340
Total	35	7,051	40	10,960
Total Steam, Motor and Sail ..	921	3,708,916	961	3,731,098

The tonnage now under construction in the United Kingdom is about 22,000 tons less than that which was in hand at the end of last quarter, but about 714,000 tons more than the tonnage building 12 months ago.

The December figures include 64 steamers and motor vessels of 1,000 tons and above, with a total tonnage of 422,553 tons, intended to carry oil in bulk.

Of the merchant vessels being built in the United Kingdom at the end of December, 710 of 2,920,656 tons are under the inspection of the surveyors of Lloyd's Register with a view to classification by this society.

MERCHANT VESSELS UNDER CONSTRUCTION IN THE WORLD

Where Building		No.	Gross tons
United Kingdom	†	829	3,474,855
	‡	57	227,010
	§	35	7,051
*Other Countries	†	811	3,182,851
	‡	132	227,492
	§	116	60,519
Total for the World	†	1,640	6,657,706
	‡	189	454,503
	§	151	67,570

*Excluding Germany, figures for which country are not yet available.

† Steam.

‡Motor.

§ Sail.

The tonnage being built in the world at the end of December under the inspection of the surveyors of Lloyd's Register excluding vessels the construction of which has not actually been commenced and excluding all vessels of less than 100 tons, amounts to 4,800,409 tons.

WORK IN HAND IN PRINCIPAL DISTRICTS

The following table gives the total figures for vessels now under construction in the principal shipbuilding districts of the country, as compared with those for the previous quarter. Each district of course includes places in the neighborhood of the port after which it is named.

District		Dec. 31, 1920 No.	Gross Tonnage	Sept. 30, 1920 No.	Gross Tonnage
Aberdeen	*	16	16,340	20	22,008
	†	1	450	1	150
Total		17	16,790	21	22,158
Barrow, Maryport and Workington	*	11	118,673	11	98,489
	†	5	34,445	5	34,900
Total		16	153,118	16	133,389

Belfast	*	48	350,020	49	343,490
	†	2	11,600	1	8,000
	‡	..	.....	3	1,240
Total		50	361,620	53	352,730
Clyde—					
Glasgow	*	165	842,986	165	834,666
	†	17	113,045	15	105,030
	‡	16	3,316	19	4,211
Total		198	959,347	199	943,907
Greenock	*	62	311,141	68	348,986
	†	5	34,700	5	34,700
	‡	..	.....	..	.....
Total		67	345,841	73	383,686
Dublin	*	13	17,725	10	13,525
Dundee	*	23	64,790	24	67,650
	†	2	600	2	600
Total		25	65,390	26	68,250
Hartlepool	*	20	97,960	23	107,640
Hull	*	43	71,218	55	73,992
	†	2	387	1	160
	‡	..	.....	..	.....
Total		45	71,605	56	74,152
Leith	*	23	52,893	26	58,343
	†	1	3,845	1	3,845
Total		24	56,738	27	62,188
Liverpool	*	54	123,219	62	143,474
	†	7	1,218	8	1,366
Total		61	124,437	70	144,840
Londonderry	*	4	26,800	4	28,000
Middleboro	*	60	281,031	56	256,503
Stockton and Whitby	‡	..	.....	..	.....
Total		60	281,031	56	256,503
Newcastle	*	122	650,541	125	653,281
	†	4	7,681	2	4,775
	‡	..	.....	1	2,670
Total		126	658,112	128	660,726
Newport, Mon.	*	5	22,696	8	38,146
	‡	4	460	2	224
Total		7	23,156	10	38,370
Southampton	*	32	59,996	36	63,981
	†	3	750	4	945
	‡	..	.....	4	600
Total		35	60,746	44	65,526
Sunderland	*	66	311,610	66	311,758
	†	3	15,510	2	10,340
Total		69	327,120	68	322,098

*Steam. †Motor. ‡Sail.

VESSELS UNDER CONSTRUCTION FOR ABROAD

Country for which intended.	No.	Gross tons.
British Dominions	12	78,320
Belgium	6	22,260
Denmark	9	31,959
France	64	319,328
Greece	11	35,895
Italy	9	87,550
Holland	27	188,846
Japan	4	25,200
Norway	101	350,287
South America	10	13,725
Spain	18	53,980
Sweden	2	10,340
United States	6	32,844
Other Countries	5	6,590
Total	284	1,257,124

OTHER DETAILS

The following details concerning the shipbuilding work of the United Kingdom during the past three months may be added:

During Quarter ended December 31, 1920		No.	Gross Tons
Vessels commenced	*	127	473,393
	†	6	29,920
	‡	15	3,040
Vessels launched	*	153	543,347
	†	10	32,705
	‡	13	3,881

*Steam. †Motor. ‡Sail.

SIZE OF VESSELS UNDER CONSTRUCTION

The following table shows the vessels under construction in the United Kingdom classified according to gross tonnage:

Gross tonnage	Number	Steam	Motor	Sail
*100 and under 500		118	21	35
500 " 1,000		108	..	..
1,000 " 2,000		96	5	..
2,000 " 3,000		80	..	..
3,000 " 4,000		74	3	..
4,000 " 5,000		57	1	..
5,000 " 6,000		92	4	..
6,000 " 8,000		90	15	..
8,000 " 10,000		50	8	..
10,000 " 12,000		4	..	..
12,000 " 15,000		28	..	..
15,000 " 20,000		25	..	..
20,000 " 25,000		7	..	..
25,000 " 30,000		..	..	..
30,000 " 40,000		..	..	..
40,000 tons and above		..	..	..
Total		829	57	35

*Vessels of less than 100 tons are not included in Lloyd's Register Shipbuilding Returns.

VESSELS UNDER CONSTRUCTION ABROAD

Countries	Steamers and Steel Vessels. No.	Gross Tons	Motor Wood Vessels. No.	Gross Tons	Sailing Vessels. Steel No.	Gross Tons	Wood No.	Gross Tons	Total No.	Gross Tons
America—										
United States—										
Atlantic Coast	129	847,814	..	.....	16	7,890	12	10,200		
Gulf Ports	23	111,726	4	5,060	..	.....	3	4,782		
Pacific Coast	43	314,380	1	1,300	..	.....	2	3,060	235	1,310,312
Great Lakes	2	4,100	..	.....	..	.....	..	.....		
British Dominions—										
Canada—										
Great Lakes	8	18,198	..	.....	..	.....	..	.....		
Coast	30	109,664	3	1,057	..	.....	9	7,840		
Australia	6	19,990	..	.....	..	.....	2	3,580	74	186,655
Hong Kong	9	24,195	..	.....	1	600	..	.....		
Others	..	.....	4	1,206	..	.....	2	325		
Belgium	9	28,048	..	.....	..	.....	..	.....	9	28,048
Brazil	1	2,170	1	1,598	..	.....	..	.....	2	3,768
China	15	46,330	5	7,294	..	.....	..	.....	20	53,624
Denmark	55	120,449	1	450	..	.....	1	380	57	121,279
Esthonia	2	1,100	..	.....	..	.....	..	.....	2	1,100
Finland	5	5,150	..	.....	..	.....	..	.....	5	5,150
France	97	395,264	2	260	3	1,935	2	510	104	397,969
Greece	1	900	1	600	..	.....	..	.....	2	1,500
Holland	170	449,399	..	.....	4	1,565	..	.....	174	450,964
Italy (in. Trieste)	68	330,834	48	19,864	..	.....	43	13,097	159	363,784
Japan	59	248,513	..	.....	..	.....	..	.....	59	248,513
Norway	48	81,367	9	2,086	2	475	..	.....	59	83,928
Portugal	..	.....	..	.....	..	.....	7	2,350	7	2,350
Spain	24	87,590	2	1,600	..	.....	1	150	27	89,340
Sweden	52	118,893	6	1,905	1	661	5	1,119	64	122,578
Total	856	*3,366,063	87	44,280	27	†13,126	89	47,393	1,059	3,470,862

*Including 9 ferro-concrete vessels of 19,087 tons. †Including 2 ferro-concrete vessels of 1,500 tons. At the end of December there were under construction abroad 105 steamers and motor vessels of 1,000 tons and above, with a total tonnage of 746,450 tons, intended to carry oil in bulk. Of these vessels 88 of 637,100 tons were building in the United States of America.

FITTING A LARGER PROPELLER TO A STEAMSHIP

At the Barcelona shipyard of the Astilleros de Mediterranean, which is now under the management of John I. Thornycroft and Co., Limited, an interesting alteration to a cargo vessel has just been successfuly carried out. Before Messrs. Thornycrofts took over the management, the steamship Olesa, of 1,000 tons deadweight, had been completed, but had failed to obtain the speed for which she had been designed. The conclusion was speedily arrived at that the fault was due to the fact that the propeller with which the vessel had been fitted was unsuitable. It was accordingly decided to increase the diameter from 5 ft. 7 in. to 9 ft. 8 in., the pitch from 7 ft. 2 3-4 in. to 7 ft. 10 1-2 in., and the surface from 16.7 to 29.3 square feet. In order to be able to do so, however, it was necessary to cut away the original stern-post and to scarph a new piece in position—a very difficult operation, since the finished job after riveting up required to be machine fitted and exactly to the gauge of the old stern-post, so as to allow of the lower rudder pintle working freely. However, the vessel was dry-docked, and the whole operation satisfactorily completed within a fortnight, the work having been carried out to the approval of a Bureau Veritas surveyor. The keel plate was extended below the normal line in order to strengthen the casting and to protect the larger propeller in the event of the vessel grounding.

The improvement effected by the change was quite remarkable. The speed was raised from 5.2 to 8.6 knots, and at the same time the vibration, which had been exceedingly bad with the small propeller, entirely disappeared. The effect on the voyage from Barcelona to Bilbao is that the steaming days are reduced from 11 to 6.7, and the saving in coal for the round voyage is 40.2 tons, the equivalent cash saving being 8,040 pesetas.

Messrs. Thornycroft remark in commenting on the result that it is not often the case that in a merchant ship the simple change of propellers can effect an increase of nearly 3½ knots in the speed, although similar results are not unknown in torpedo-boat destroyers and high-speed motor boats.—The Engineer.

Ontario Specialties Company, Ltd., head office and works in Ottawa, have opened up an office in Montreal, at Room 702 Southam Building, under the management of J. H. Cowan. The firm are manufacturers of marine specialties, ships' bells, whistles, port lights, etc.

The Present Status of the Diesel Engine

Two Cycle, Four Cycle, Solid and Vaporized Injection, Are Some of the Controversial Points Touched On. Problems of Design and Economy Possible Under Different Conditions Pointed Out

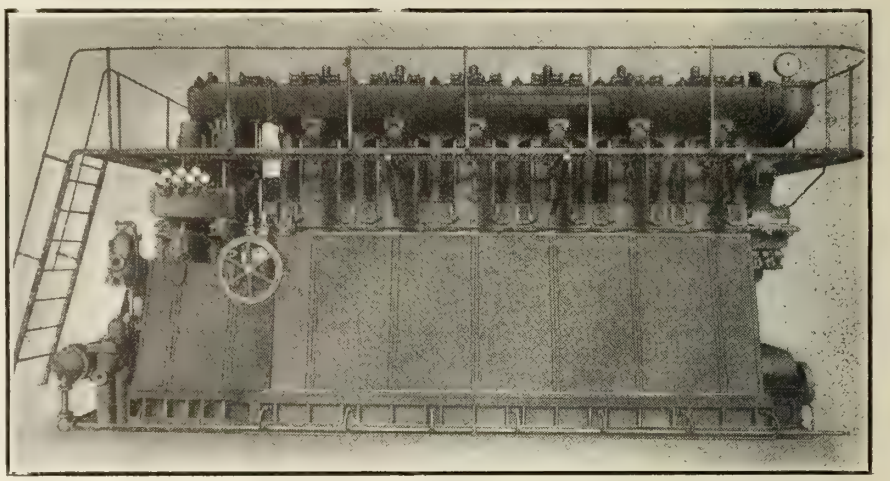
PROGRESS in the development of the Diesel engine was almost at a standstill during the period of the war. At the present time engineers are again turning their attention to this class of power producer, especially for marine work, inasmuch as it is one of the most economical of engines. It is very satisfactory to know that more Diesel work has been undertaken during the past few years than in any previous period. Many of the salient features are now appreciated, and growing interest is stimulated and met by an ever-increasing volume of technical literature on the subject.

Modern experience with the most economical steam installations applicable to ships of average speed, namely, the steam turbine with double reducing gearing has demonstrated that the step from single to double reduction is not merely a question of multiplication, but that many new factors have been introduced, such as alignment of shafts, material and design of intermeshing teeth, pressure and rubbing velocity between teeth, etc. Thus it will be seen that the Diesel engineer has an added incentive to bring his engine to the fore.

The past record on oil engines at sea shows in a striking manner the relative success of the four cycle principle applied to single acting engines. Were reduction of weight, compactness, and maximum power per unit volume of ship occupied by internal combustion machinery were the chief considerations, the four-cycle engine was found the most suitable for meeting these conditions. In Germany the two-cycle engine was most favored for marine work prior to 1914, but for submarine work during the war this system was dropped. Ultimately by far the larger number of Hun submarines, and all having the highest power per unit, had four-cycle engines. In the British navy the four-cycle principle was almost exclusively adhered to. Of the marine Diesels now under construction in the different countries, 84 per cent. of the ships are twin screw, and 80 per cent. of the total number of engines are of the four-stroke cycle type. In Britain the two-stroke cycle type is more favored than elsewhere.

The most important of the problems of design are common to both two and four cycle engines, and the first concerns the injection of the oil into the cylinder. The exact quantity of a fuel at a pressure sufficient to insure injection must be measured out by the pump during some 30 degrees of revolution, as widely as possible into the combustion space, in a very finely divided state, to insure rapid ignition and satisfactory combustion. It is chiefly in this direction of improving distribution in the combustion chamber that increased economy can be sought. There are two methods of spraying: one by means of compressed air, the other by injecting the fuel at a high pressure, known as the solid injection system. The use of compressed air is most general. So far as marine engines are concerned, the main advantage of the solid injection system is that the compressors are not a part of the main propelling engine and do not require to be run continuously at sea; they are only used for supplying air for manoeuvering purposes. Further, the air compressor plant, where solid injection is adopted, can be reduced by from 40 to 50 per cent. in capacity, which is quite a consideration.

Reliability with air compressors delivering fuel at 850 to 1,000 lbs. per square inch has reached a high level, yet it is not to be inferred that finality has been reached in compressor design or in methods of injection. In regard to the former a better method is required for removing oil and moisture from the air, and in respect to injection a more suitable valve should be produced, which, while requiring compressed air spray for full power and maximum efficiency, can still operate satisfactorily at reduced power without the assistance of compressed air. The other fundamental of injection, the measuring of the fuel, involved the most delicate apparatus associated with the Diesel engine, the fuel injection pumps and control gear. The system of having one pump per cylinder is now almost universal (excepting where solid injection is used), and only in this way can the maximum security against a large overcharge in one or more of the cylinders be obtained. Even with separate pumps, the most intelligent supervision must be exercised to insure that the deliveries from the pumps are maintained equal, lest one or more cylinders are overloaded to counteract the effect of diminished deliveries from defective working pumps. Means are now generally provided whereby any pump can be cut out and overhauled whilst the remainder are in operation.



600 H.P. CRUDE OIL MARINE ENGINE.

The Diesel engine remains a heavy and expensive prime mover in comparison with its steam rival. Even with the progress made in design during recent years, it can be stated definitely that there has been generally an increase in weight and in the space occupied by the slow speed Diesel engine, per horsepower developed continuously. The factors opposed to these disabilities and rendering difficult the path towards the higher powers now desired are, the temperature gradient through the metal surrounding the combustion chamber, and the fact that the major portion of the material of the engine is only utilized for a small fraction of the running time. The former refers to the two cycle, and the latter to the four cycle engine where three-fourths of the running time is idle, so far as power output is concerned.

To appreciate the stresses to which the main parts of a Diesel engine are subjected, comparison may be made with a steam engine of normal design and

equal power output. The maximum normal load with the oil engine is more than five times as great, and furthermore the rate of application of this main load is increased ten times. With internal combustion the normal stresses are liable to sudden increases calling for a larger factor of safety, and design questions relating to the main parts of the engine must be considered strictly in this light. In regard to the temperature gradient and the stresses so incurred data are lacking; but so far as they are available, they go definitely to prove that the four-cycle engine has distinct advantages. With the cylinder liner the transmission of heat is a function subsidiary to the more important duties of guiding the power piston and maintaining a suitable surface to permit of piston-ring gas-tightness, with minimum friction. The simple design of liner adopted up to the present cannot be approved on theoretical lines. To obtain a minimum value for the combined stress consequent upon the temperature gradient through the metal and internal pressure, a ribbed and built-up form of construction must be adopted. This can be accomplished very simply with the four-cycle engine, but imposes greater difficulties in the case of the two cycle, where exhaust and scavanger ports have to be accommodated in the cylinder.

The Diesel engine is a complicated machine, highly loaded, and stressed by high pressure combustion within the cylinder; short cuts to achieve reduction in space, weight and cost will only be fruitful in so far as first principles and fundamentals, more especially in respect of rate of heat transmission, are not violated. The foregoing conditions of design of the Diesel engine prevent it from being a cheap and light prime mover. Yet increased experience, better materials, more efficient utilization of such masses as are required to cope with the pressure of the cycle, together with standardization, will in due course effect a reduction in these disabilities.

At present the cost can be stated to be from 25 to 33 per cent. more than that for a steam plant, depending on the type of auxiliary applied to the oil engine ship and whether comparison is made with reciprocating or double reduction turbine steam machinery. This higher cost is minimized in effect by the greater cargo-carrying capacity sometimes possible by the adoption of oil engines, or alternatively by the fact that a smaller Diesel-engined ship serves to give earning capacity equal to that of a steamer of greater size. The economy of operation possible with the oil engine is such that, granted reliable performance, the extra cost is speedily balanced by the increased profits obtainable.

Under the entirely new conditions now operating it is pleasing to reflect that in England there are under construction a larger variety of types of marine oil engines than in any other country, indicating an enterprising and progressive policy of determined trial. This is in strong contrast to the apathy with which the country was charged before the war. Experience in due course with these engines will go far to enable relative values to be given to various systems and types of construction. In time a few may be eliminated, as has been the case with other prime movers, but the majority will remain until gradual development and increased application enables a higher plane of performance to be reached, when the issue will be narrowed down.

What the future holds in store cannot be forecast. Sufficient for the moment is the fact that there are many known problems with internal combustion engines to which only at best comparatively clumsy solutions have so far been found. Improvement of the present state of this scheme calls for the highest efforts of engineering skill, and the time has arrived when energy and enterprise expended in such a direction may look expectantly for the just reward of a broadening application to marine work.

At the present time there are 284,000 tons of shipping being built which are being engined by Diesel and semi-Diesel engine; this is in excess of last year.

General Particulars.	Single-screw Diesel 1000 H.P.	Single-screw Double reduction geared 1000 S.H.P.		Single-screw Reciprocating 1200 I.H.P.	
		Coal	Oil	Coal	Oil
Fuel, lbs. per H.P., per hour	.45	1.5	1.1	1.95	1.4
Consumption, tons per day	4.82	16.1	11.8	25	18
Consumption, tons per 30 days...	145	483	354	750	540
Price of fuel per ton	$53	$24	$48	$24	$48
Cost of fuel per 30 days	$7,750	$11,735	$17,200	$18,225	$26,244
Lubricating oil consumption, gallons per day	10	2	2	3	3
Lubricating oil, cost per gallon...	$1 20	$1.20	$1.20	$1.20	$1.20
Lubricating oil, cost per 30 days..	$364	$72	$72	$109	$109
Personnel					
Chief Engineer	1	1	1	1	1
Assistant Engineers	3	2	2	2	2
Greasers	3	3	3	3	3
Firemen	..	3	3	3	3
Trimmers	..	3	..	3	..
Donkeymen	1	1	1	1	1
Electrician	1	..	..	..	..
Total engine room staff	9	13	10	13	10
Total wages, 30 days	$928	$1,089	$946	$1,089	$946
Total keep, per 30 days, at $1.68 per day	$458	$662	$510	$662	$510
Total wages, fuel, oil, and keep for 30 days	$9,502	$13,564	$18,735	$20,097	$27,810
Ratio	1	1.44	1.97	2.12	2.93
Net saving per annum of 200 days sailing, Diesel over steam	..	$27,070	$61,479	$70,567	$122,715

Comparison of Running Costs of Diesel Ships and Steam Ships of 1,000 Brake Horse Power.

(NOTE.—In addition to the above, the following savings are effected: Fueling costs, less demurrage, additional cargo capacity, less accommodation for engine room staff, no stand-by losses, less cleaning ship, higher average speed in a sea-way, reduced fueling appliances required, etc.)

*This abstract is from a treatise on the Diesel engine by James Richardson, B.Sc., of the marine engineering department of Beardmore & Co., Dalmuir, Scotland.

MERGER THROUGH IN SMALLER SHAPE

MONTREAL.—At the conclusion of the recent conference between the Dominion Steel Corporation and the Nova Scotia Steel & Coal Companies, it was officially announced that directors of these companies had arrived at an agreement for the consolidation of the Dominion Steel Corporation, Ltd., the Nova Scotia Steel & Coal Co. and the Halifax Shipyards, Ltd., under the name of the British Empire Steel Corporation, Ltd.

The agreements are subject to the underwriting of certain securities, upon the completion of which the boards of the companies will again meet for the purpose of approving the underwriting and fixing the date when the agreements will be laid before the shareholders of the interested companies for their approval.

No indication of what the amount to be underwritten will be is given, or in what form it will be, so that the next meeting of the directors for its approval is a matter of conjecture.

The amalgamation of the Dominion Steel Corporation and the Nova Scotia Steel & Coal Company has been considered by some a logical proposition, owing to the situations and workings of the two industries. The inclusion of the Halifax Shipyards will come as a surprise to some, but not to others. The Canada Steamship Lines have not been mentioned, although a cable from London states that in an interview with Col. Grant Morden the latter says the steamship company will closely co-operate.

Any appendage to the amalgamation of the two big steel concerns will be a source of disappointment to many in the street here, who had hoped that the two enterprises would work alone, their merging having been advocated for years.

The Port of Vancouver During the Year 1920

Vancouver and the Province of British Columbia in General Reviewed From a Number of Different Trade Angles, Including Shipping and Port Development, Building and Engineering

By E. B. B. REESOR

PART OF VANCOUVER'S WATERFRONT.

VANCOUVER, "Canada's Pacific Port of Predestination," so termed by Lord Burnham at the time of his visit with other Imperial press delegates during the summer of 1920, is the commercial capital of British Columbia and the pulse of the industrial activities of the whole province, though those things that are manufactured in Vancouver city alone, would not convey an adequate idea of the manufacturing business and interests controlled there.

At the end of December, 1919, exceptional activity was shown in every branch of industry in British Columbia. During the first half of 1920 this activity was kept up. Prices were still rising and there was a shortage of nearly every basic commodity. It was evident that this shortage must be made up. "Coupled with this world-demand for commodities," said Mr. J. H. Hamilton, editor of Industrial Progress, "British Columbia was facing a deferred programme of necessary development, projected before the war and necessarily postponed, and, taken altogether, the outlook was full of promise for a continuance of active, prosperous conditions. Despite the sound and healthy state of business within British Columbia the province has, naturally, reacted to the general depression which has developed throughout the commercial world during the latter half of the year under review. It is a peculiar fact, however, that Western Canada is always slower to react to outside commercial influences than are other parts of Canada and of the United States."

The chief adverse results, from the general depression was the severe restriction of the mining and the lumber industries, both being very large consumers of materials produced within British Columbia, as well as being producers of wealth which was distributed by means of big payrolls. Against this adversity is the prosperity due to the buying power created by the bounteous crops throughout the middle West, which has gone far to sustain business conditions. Then, the very violence of the drop in basic commodity prices means that a reaction will set in early in the year (indeed, on this 28th day of January it is felt that it has already begun), and conditions will naturally readjust themselves.

Thus, looking back over the year 1920 it may be truly said that British Columbia industries have, as a whole, enjoyed a prosperous year.

Lumber

In the beginning of 1920 lumber, shingles, pulp and paper mills were booming to an unprecedented degree. Prices were on the upgrade and the demand for all grades from the United States and other world markets continued at a feverish rate. So great was the demand that "prices ran away with themselves." Then came an increase in freight rates, and, from the peak of prosperity in May there came a decrease of from 38 per cent. to 42 per cent. to the end of the year.

Statistics

Log stocks at Vancouver and Fraser River, December, 1919, 62,000,000 ft.; December, 1920, 100,000,000 ft.

Coast stocks of lumber January 1st, 1920, 192,000,000 ft.; December 1st, 1920, 170,000,000 ft.

Mountain (interior), mills, total production, 1919, 258,000,000 ft.; total production, 1920, 290,000,000 ft.

Shipments 1919, 315,000,000 ft.

Shipments, 1920, 220,000,000 ft.

Stock on hand, 1919, 88,000,000 ft.

Stock on hand, 1920, 160,000,000 ft.

Pulp and Paper

Beginning in the year 1911 there was an output in British Columbia of 90 tons of chemical pulp; in 1919, there was an output of 52,000 tons chemical pulp, 65,000 tons mechanical pulp; 123,000 tons newsprint paper; 7,200 tons wrapping paper; making a total money value in 1919 of $12,554,000 for the one year.

This rate of growth is likely to continue.

The products of the pulp and paper industry are shipped mainly to the United States of America, to Australia, to Japan, and much is used in Canada.

Even this market has not escaped the general turmoil of commercial conditions, but orders are available for the entire output, and during 1921 the factories will be working full time. Any trouble has been connected with finance, not with demand.

Mining

From a broad point of view the mining conditions in British Columbia are good, but, from a narrower outlook they are not so good. There are comparatively few mines in the 395,000 square miles of British Columbia that have been developed to the shipping stage, but, taking into account the developing and prospecting work that has been done it means that much progress has been made during the year.

During the war years there was a keen demand for British Columbia metals. This gave a hectic stimulus to the industry and the mines and smelters reaped rich rewards. The money made is now being used for development of mines in the mining areas.

The actual output of copper, lead and zinc during 1920 was little less than the

INDUSTRIAL VANCOUVER FROM CONNAUGHT BRIDGE.

output during 1919, but the money value of those products is considerably less, owing to the lower prices prevailing.

Quartz and gold mining suffered equally with the baser metals.

Silver was profitable until the close of the year.

Coal and coke have been normal.

Iron resources have been brought one stage nearer to development.

Oil drilling is continuing; nothing great has been struck.

The Epsom salts and the soda lakes along the line of the P.G.E. within 200 miles of Vancouver are being worked. Their products are sent to Orville, State of Washington, for refining and distribution.

Fisheries

The packers have disposed of nearly all their year's pack of sockeye fish, but are still carrying a large proportion of the pack of inferior grades—which is unfavorable. No inferior grades were packed during 1919; the call for them previously was on account of food shortage.

The year 1920 may be considered a fair one for the canning industry and most of those engaged in it show a good return for the season's operations. Herring are an increasingly important factor, and the latest report from Nanaimo (January 24, 1921), says: "Never in the past ten years has the herring fishing been carried to such an extent as to-day. Each boat is averaging two tons per day, for which the fishermen receive from $17.00 to $20.00. During the last three months of 1920 there were 600 tons of herring caught in Departure Bay. These fish brought an average sum of $30.00 per ton f.o.b. in Vancouver. The herring run will last until the end of February. Sea gulls are hovering about in unnumbered flocks."

The whaling season provided an average catch, but its principal product, whale oil, has slumped in price to a point where its market value is below the cost of production, and a large proportion of the season's product remains in the refiners' hands. Unless the market recovers it stands to reason that operations next season will be restricted.

Agriculture

The growing, picking, packing, canning and marketing of British Columbia fruits and vegetables is increasing every year; weather conditions make the crops vary in size and in quality, but, taking all parts of the province into consideration, the year 1920 was an excellent one for agriculturists.

Shipbuilding

Ocean-going vessels were not built in British Columbia prior to the year 1917. To compare the actual output of ships built in any one year with any other year is difficult, for the reason that it is customary to give the total tonnage laid down, launched and completed within the period.

During 1920 there were 13 steel ocean-going ships launched, with a total tonnage of 154,000 deadweight tons, and a total contract value of $28,180,000.

At the end of 1920 there remained in course of construction and not yet launched 3 steel steamers of a total of 25,000 tons deadweight, of a contract value of $4,700,000.

At the end of 1920 there were orders still on hand for which keels had not yet been laid, for 2 steel steamers totalling 16,780 tons, contract value $2,800,000. One wooden schooner 2,500 tons.

Shipping and Port Development

A recognition of the importance of the relationship of ships and ports to the matter of foreign trade has been complete on the part of the Canadian Government, and the progress of Vancouver and Victoria as British Columbia ports is of vital importance to all Canada. At no time in the history of Vancouver have so many ships visited the port, nor from so many countries, as during the year 1920, nor have so many nor so varied products of foreign countries been landed at her docks. Also the manufactured products of Canada and the United States, and the raw materials of British Columbia have been shipped from the port of Vancouver in greater quantities and more varied kinds than ever before. A start has been made, and nothing short of the world's end or the obliteration of the port can stem the tide of exports and imports that 1920 has been the real beginning of.

New overseas steamship connections during 1920 were established by lines to British India, to France, to South America, to Holland, to Scandinavia, to New York, also additional lines to Australia and New Zealand; and lines projected to British West Indies and further lines to Great Britain.

Building and Engineering

Outside of the building of homes, of stores, of banks, warehouses and many alterations to and enlargements of stores, garages, hotels, schools, public halls, etc., Vancouver's principal constructions consist of the Canadian Pacific Railway new ocean dock, the Ballantyne pier, Coghlan's graving dock, the Union Bank, Allen theatre, Capitol theatre and the railroad terminals of the Canadian Northern Railway. Extensive building programmes have been prepared for the year 1921. Other work

INDUSTRIAL ISLAND. RECLAIMED LAND IN THE HEART OF THE BUSINESS DISTRICT.

THE "BUENOS AYRES" AT THE DOMINION GOVERNMENT DOCK.

completed in the province includes the extension of the Canadian National Railway from Kamloops to the Okanagan Lake. Completion of the Canadian National Railway on the Victoria-Alberni route on Vancouver Island. The big Sumas reclamation scheme where the great flats, not far from Vancouver, will be reclaimed and dyked to prevent overflowing by floods and general swampiness, and be converted into rich and near-market farm lands. The Osoyoos irrigation scheme, whereby a large tract of Southern Dry Belt mountain benches are turned into valuable fruit-growing orchards; and the Bridge River Hydro-Electric scheme survey work completed.

General Industries

Manufacturing industries had a good year. A number of important new industries were established, while other industries, organized during 1919, swung into the producing stage during 1920. A partial list of new industries includes:

Steel wire rope (Britannia Wire Rope Company, Ltd.).

Cordage (Western Canada Cordage Company, Ltd.).

Rubber goods and tires (Gregory Tire and Rubber Co., Ltd.).

Pulp board (Pacific Roofing Co., Ltd.).

Rubber soles and heels (Imperial Manufacturing Company).

Wood distillation by-products (Acetate Products, Ltd.).

Coal by-product recovery plant (Granby Consolidated, Ltd.).

Toys (Western Toy and Furniture Co., Ltd.).

Cast iron pipe (Vancouver Pipe and Foundry, Ltd.).

Paper bags (British Pacific Paper Bag Company, Ltd.).

Neckwear (Kerr Manufacturing Co., Ltd.).

Dolls (Canada Doll Company, Ltd.).

Sandpaper (Canada Abrasive Paper Company, Ltd.).

Saws (Aetna Saw Works, Ltd.).

Silica and glass (Canada Silica Works, Ltd.).

Turpentine (Douglas Fir Turpentine, Ltd.).

And right in the heart of Vancouver city, an island built in False creek, where vessels can swing on to the private wharves of manufacturers during times of a high tide, a most important industrial section has been developed, among things made there being:

Manufacturing of clay into types of earthenware; paint, in all grades and colors; glass for bottles and other containers; boilers, engines, ship machinery outfitting, fish cannings, pickle bottles, water power wheels, talc products, sheet metal, ventilating and blowing equipments, hide tanning, electric switch, fuses and fixtures; carbonic acid gas.

Also a woollen manufacture and a meat packing plant are other new 1920 Vancouver industries.

Power Sales During Five Months

The power sales department of the B. C. E. R. Company, Ltd., reports that there was an increase of 500 per cent. in the load contracted for during five months of 1920. One hundred new power accounts were opened during that time; 220 motors connected, aggregating 3,280 h.p. as compared with 645 during the same period in 1919.

The generating stations have also felt the effect of this power selling activity for there has been an increase of the k.w. hrs. generated of 28 per cent., being equivalent to 17,772,156 k.w. hrs. for the same period. Since the above estimates were made the B. C. Electric Railway Company has taken over the Western Canada Power Company's interests.

B.C. Industrial Corporations during 1920.

		Capitalized at
Agricultural, fruit canning, etc.	29	$ 2,624,000
Fishing, salmon, canning, etc....	21	1,255,000
Lumber, shingles, etc., pulp and paper	156	21,386,000
Mining, smelting, oil, etc.	74	34,600,000
Metal industry and engineering..	20	2,849,000
Shipbuilding, shipping, transportation	9	5,605,000
Miscellaneous industries	18	4,142,000
		$72,461,000
Importers and exporters	21	1,665,000
		$74,126,000

ENGLISH MOTOR LIFE-BOATS

The following account of the latest motor life-boats used on the coast of England was obtained from the officer in charge of the Department of Overseas Trade in Toronto.

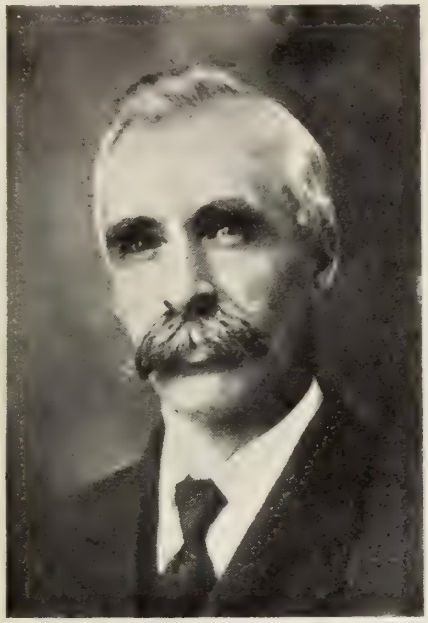
It is a matter of supreme necessity for life-boats to be composed of the very best materials and for their installations to be as free from failure as possible, expense being quite secondary. Life-boats are, in the large majority of cases, called out in rough weather, and any failure of the machinery would not only affect the usefulness of the life-boat with regard to giving succor to shipwrecked crews, but would also endanger the safety of the life-boat crew itself. It is, therefore, vitally necessary that nothing should be put into the life-boat machinery which would have the possibility of going wrong while in service. The British Life-boat Institution has now had years of experience with motor life-boats, and its specifications are drawn up with extreme care, so that the latest constructions embody the best of their experience in motors of this kind.

In view of the above considerations it will be appreciated that the new motor life-boats recently installed in Great Britain are of interest in all parts of the world where shipwrecks are likely to occur, and this opportunity has been taken to give a description of the most recent types.

In the first place the engine hatch has to be screwed down before a start is made in order to keep the water away from the engine, and it cannot be safely opened again until the end of the trip. The space below the deck is filled with a number of wooden air cases shaped to fit, and covered with calico so as to render them perfectly water-tight. Large air cases are also placed at the bows and stern and, together with the iron keel, render the boat self-righting. A special construction has been adopted for the propeller tunnel which protects it from contact with the bottom of the boat and floating wreckage. The engine room is water-tight, being completely lined with copper with soldered joints. For sailing and rowing the boat is fitted with a full equipment such as would be supplied for a life-boat without a motor. Water-tight hatches are arranged in the

decks over the propeller and the stern gland so that that the reverse gear can be inspected. Owing to the fact that the engine is enclosed in a water-tight case, special provision has to be made for a supply of air. This is effected by a pipe leading down from the engine casing into the air box where it rises vertically to a considerable height. Cool air is admitted by a special form of valve, comprising a brass ball protected by a brass grid so as to prevent the entry of water should the boat capsize. Fresh water is used for cooling the engine, but sea water may be circulated instead if necessary. The design of the ignition apparatus is, to a landsman, one of the most interesting points about a life-boat motor installation. All those who run motors at sea know how prone the electrical gear is to suffer damage from salt water, which not only attacks some materials, but is itself a conductor of electricity. This difficulty has been overcome in life-boat installations by the use of special water-tight switch boxes, together with ebonite insulation for the wiring and a reduction of the voltage in the primary circuit. The electrical fittings throughout are made, so far as possible, water-tight. A very necessary item is the capsizing switch which breaks the circuit should the boat capsize and then right itself, for if this were not fitted the boat would go ahead as soon as it had regained its equilibrium and leave the crew behind in the water. In the ignition circuit, therefore, is the switch in which the circuit is completed through mercury. If the boat capsizes the mercury falls into an upper compartment and on righting trickles back very slowly during a period of 30 seconds, thus stopping the motor and leaving it ready to start again when required. The engine is fitted with a governor, which acts on a separate throttle and is in no way connected with the hand control gear. It is really to prevent the engine from racing if a shaft breaks or if the boat is bumping over a sandbank. The engine will run for an indefinite period dead slow and yet pick up speed again without hesitation when the throttle is opened. Half a turn of the reversing wheel puts the gear from ahead to astern. The only other control is the throttle lever. So flexible is the engine that the speed can be reduced to 25 per cent. of the normal, while the reversing wheel may be turned from ahead to astern, or vice versa, with any position of the throttle, without the slightest risk of the motor stopping or damage accruing.

With regard to special cocks and fittings no standard products are deemed to be satisfactory. Ordinary petrol cocks, for instance, are not substantial enough to be absolutely reliable as they are liable to leak or the springs or cotters to rust and give trouble. The special cocks have long plugs fitted with glands at the lower end held tight by bronze springs. The same attention to detail follows the type right through from start to finish and the motor life-boat may be regarded as one of the special applications for which the British genius for careful design and high-grade production is particularly suitable.



M. HAMELIN

NEW INVENTION

Mr. J. Hamelin, of Levis, P.Q., is the inventor in conjunction with his brother, Mr. F. X. Hamelin, of the turbine described in our January issue.

Mr. Hamelin has had a long engineering experience, commencing with the old established and well known firm of Carrier, Laine & Co., Levis. He went from there to the Campagnie Industrielle de Levis, and left them to become engineer of the Richelieu and Ontario steamer "Quebec." He became later superintendent engineer for the Levis Ferry Company, and held that position for ten years, subsequently becoming the representative of the "Bureau Veritas." He superintended in this capacity the construction of the vessels built at Levis for the French Government, and also acted as receiver for the same government.

Born in Levis in 1865, Mr. Hamelin is now 56 years of age. He has always been deeply interested in his chosen profession and has spent much time experimenting. Like all good French-Canadians, he is never so happy as when in the midst of his family. Mr. and Mrs. Hamelin are the proud parents of three sons and four daughters.

INCREASE IN TRANS-ATLANTIC MARCONI RATES

The Marconi Wireless Telegraph Company of Canada, Limited, announces an increase in its trans-Atlantic rates, effective January 25, 1921.

The new rush service rate from points in Nova Scotia, New Brunswick, Quebec and Ontario is 18 cents per word as against the old rate of 16 cents per word. Corresponding increases on messages from Manitoba, Alberta, Saskatchewan and British Columbia are announced.

The company points out that the increase of two cents per word is necessitated by the fact that connecting land lines have from time to time put into effect increased rates, and that the increase in the through Marconi rate is entirely absorbed by these increased outpayments to the land line companies. In other words, in spite of the fact of the much higher cost of operating its wireless stations, the company is not asking a higher rate for the wireless haul, merely raising the through rate to cover its increased outpayments to connecting lines. The new rate of 18 cents per word from Eastern Canada to the United Kingdom is still seven cents less than the existing cable rate for similar service.

NEW MARCONI WIRELESS STATION

To meet the requirements of the Canadian travelling public, the Marconi Wireless Telegraph Company of Canada, Limited, has erected a new wireless station at Louisburg.

The special purpose of this station is the transmission of daily bulletins of Canadian news to trans-Atlantic passenger liners. In the past travelling Canadians have remarked on the fact that, while a certain amount of British and United States press bulletins have been published on board vessels on the Atlantic, there has been a dearth of Canadian news items, which naturally provide the most interest to the Canadian traveller.

The Canadian Marconi Company's new Cape Breton station, therefore, supplies a real need, and as the apparatus installed at this station comprises the very latest types of wireless equipment, an excellent press service is being rendered.

The new station commenced operation on the 13th December, 1920, and, under arrangement with the Canadian Pacific Ocean Services, Limited, a daily bulletin has been transmitted to C.P.O.S. liners from that date. Vessels of other steamship lines have also taken advantage of this service, with the result that Canadians on the high seas can now keep in daily touch with home events.

Announcement is made that H. B. Smith, president of the Collingwood Shipbuilding Company, Limited, and a director of the Canada Steamship Lines, has been made president of Halifax Shipyards, Limited, succeeding Roy M. Wolvin, who has retired owing to the pressing duties of his position as president of the Dominion Steel Corporation. Halifax Shipyards is one of the chain of shipbuilding companies slated to enter the British Empire Steel Corporation merger, and it is said that Mr. Smith will be the shipbuilding director for the big corporation's chain of yards on the Canadian waterways.

Safeguarding Operation of Industrial Cranes

Crane Inspection, Safety Devices, Proper Slings, Duties of Operator, Proper Chains to Use for Different Purposes, the Endless Chain Sling, Identification of Chains

By JOHN A. HOPE

THE rules and regulations, herewith set forth, governing the shop maintenance of cranes and hoisting chains, and care of the same, is submitted by the writer, recognizing the importance and considerate attention that has been given to this subject by one of Canada's leading railroad companies, in safeguarding workmen from injury. It is doubtless true that many industrial firms have adopted ways and means for the protection of the workmen that may be similar to those here given, but a brief discussion of some details at this time may prove beneficial to many of the readers.

Shop Cranes

The general construction of modern workshops provide ample overhead room for carrier cranes, and according to the length of the building and the nature of the work, two or more of these cranes may be operating on the one runway, with a minimum tracking height of about 330 feet from the floor. The duties of these cranes involve the rapid transit of shop material from one department to another, where floor conveyances are not convenient. The operators in charge of the cranes are constantly engaged in the different positions below them and seldom are required to watch the movement of the crane along the tracks, and therefore assume that there are no obstructions to the crane tracking when moving along the rails. This makes shop orders effective that no class of workmen, steam fitters, etc., working on maintenance of building, are allowed to work in the vicinity of cranes, except in the case of emergency repairs which must necessitate the stopping of the crane from operating in the section where the trouble may be.

Crane Indication

It is most advisable that all cranes be painted with a light distinguishable color, to contrast sharply with the building interior and surroundings, so that they will be quite noticeable to all floor men in the works; also that the rated capacity of the crane be stenciled in large lettering on both sides or bridges. This capacity should always read in tons, as men do not grasp the significance of pounds capacity as well as they do tonnage.

Crane Safety Devices

In order to facilitate repairs, all cranes should be equipped with suitable runways that will provide easy access to carrying transmission, propelling gears, bearings, motors, etc. These runways likewise permit of ready inspection at all times. All overhead crane equipment should be controlled by limit switches for extreme load height; also include the best features in drum clutch and brake devices, automatic gong ringer, etc.

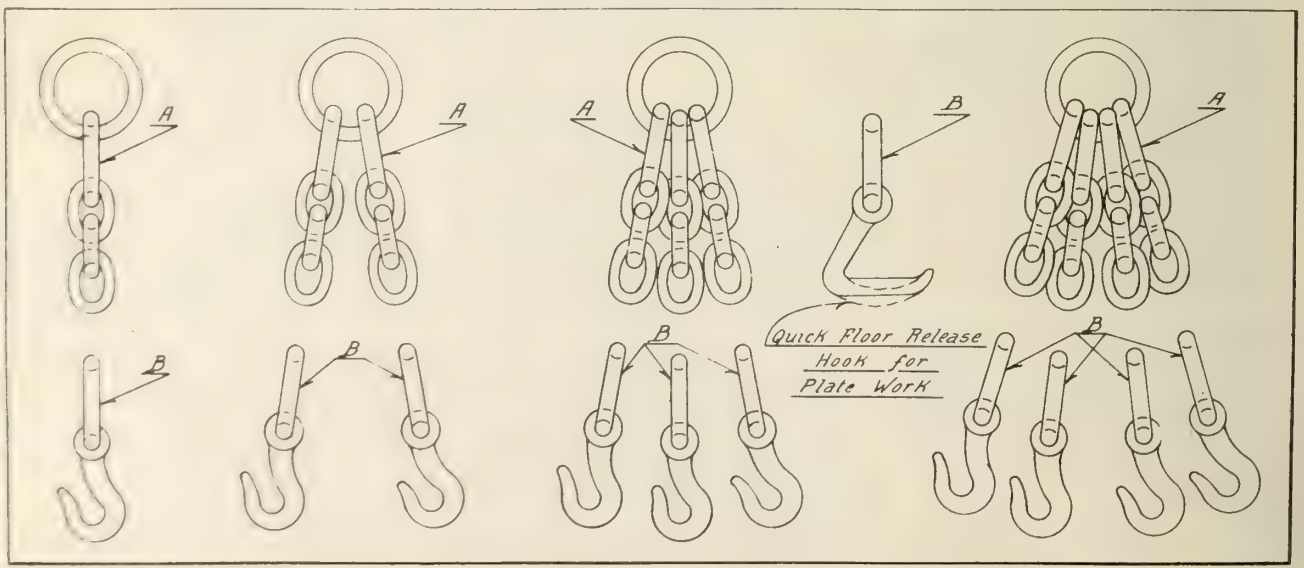
Crane Inspection

Whether the number of cranes warrant an inspector on the job all of the time or only part of it, it is necessary that cranes receive a close inspection at least once a week. This inspection must include a very careful examination of the hoisting cables, to ascertain that there are no damaged or broken strands, and that cable sheaves are not worn to cause any cable defects. It is possible and expected that a good brand of cable, kept in good condition by frequent oiling and used for moderate lifting within crane capacity, should at least give a satisfactory twelve months' service, that is, for machine shop service; foundry cranes cannot be governed by this rule, on account of the extra usage and the continual dust. However, there is no other interpretation of the shop rule, which states, each or any cable inspected and discovered with broken wire in strand must be immediately discarded and new cable applied, irrespective of what length of service damaged cable has been in use.

As previously stated, cables on general service cranes (excepting foundries) should have a predetermined renewal date set, according to the number of days or hours crane is in use, always taking into consideration the nature of the material handled, for although cables may not show weakness in broken strand wires, the breaking strain may be very materially reduced, with too continued service.

Crane Operators and Slings

The present practice, where one or more carrier cranes are in continuous use, is to provide a competent slinger, who takes the responsibility of slinging all material to be handled, and in seeing that all material is placed in the proper position. Rules applying to crane operators and slingers are for eliminating any misunderstanding. 1st.—Crane operator being responsible for material load when hoisted, that there is no undue swing to load, and that observance is made to clear projecting wall cranes, etc. 2nd.—That crane operator takes his signals from slinger with respect to hoisting, lowering, or carrying of ma-



A ONE, TWO, THREE AND FOUR-LEG SET OF CHAINS.

terial. 3rd.—That crane operator can refuse to make load lift, if in his estimation improper fastenings or under capacity slings or chains are used by slinger. 4th.—Slinger to be fully competent in the use and capacity selection of chains which are at his disposal and generally indicated for their special use. 5th.—That in handling or placing material in a predetermined position for mechanics involved, all signals must be transmitted through the slinger to the crane operator, for too many signal bosses will tend to create accidents and cause unnecessary confusion. Cordial co-operation is demanded from crane operator and slinger, and where repeated friction is apparent in the handling of material, a change is effected.

Chains

In the accompanying sketch are shown a set of one, two, three and four leg chains, and these are considered as the most serviceable for all round use in foundry, machine and erecting shop service, not excepting the endless chain sling. These chain lengths are made up of No. 1 best tested, oval link, wrought iron, for hoisting purposes, covering a lifted range from 1-4 to 20 tons, as illustrated. This is in reference to general shop use, as there are a large variety of special chains for work of specific character. With reference to the head ring on these chains they are made a relative size for the different chains, to facilitate hooking on to the carrier crane main hook. Ring thickness is made to suit the chain capacity. Chain data is omitted in this article, as this information may be had from any of the hand-books now available. The safety factor used for hoisting chains approximates 5 to 7, that is, 1-5 to 1-7 the breaking strain of chain being the allowable carrying load.

It is freely conceded that the one and two leg hook chains, and also the endless sling chain, are the most expedient and desirable for handling material in erecting, foundry and structural work. The two, three and four leg chains, with different width hooks, are the best adapted for boiler and tank plate work. The three leg chain is recognized as the safest flat plate carrier on account of its three point suspension, thereby decreasing the possibility of plate slipping.

Rope Slings

Manila or hemp rope slings are not included in the shop equipment for general sling work, on account of being subject to strand cutting when used on rough or sharp edged material, yet their field of usefulness is so extensive that it is almost essential to provide such slings for specific uses. The 1-inch and 1¼-inch rope slings (endless) are much preferred by erecting millwrights. Light material that is being installed down from large or heavily constructed machinery, necessarily requires a light sling, and where small parts are being handled in a confined space, with the probability of being jammed, the rope is more suitable, as it enables the operator to watch any crowding of the work against adjoining machinery. Light ¼-inch chain slings, where a heavy power crane is doing the work, will not stand up to this momentary strain, and frequently results in a bursted link and falling of material. Rope slings are very serviceable when placing light material inside of locomotive boilers, where view is obstructed.

Tube handling in large quantities give preference to the 2 and 2½-inch diameter endless rope sling, as it has a natural tendency to hug the tubes securely and preventing slipping, and in the case of thin tubes, avoiding damage to the same.

The Endless Chain Sling

This chain, in ¼ and 5/16 inch open link sizes, ranging from 3 to 5 feet in length, is regarded by machine shop operators as one of the most necessary individual pieces of equipment of any they have got. These chains are used with wall cranes equipped with air hoists or quick-acting chain blocks as lifting mediums, the average weight of material handled being from 100 to 1,000 lbs. Mechanics making daily use of such chains carry their work out in routine manner, so that little thought is given to the possibility of chain breaking and causing injury. The need of regular inspection is therefore obvious. The following is a conversation the writer had recently with a workman using a chain as cited above.

"Where is your chain sling?" Machine operator produces the same. "How long have you been using this chain?" "Possibly five months." "Have you ever examined the individual links in the chain for possible defects?" "Well to be candid—No. I did not." "Don't you think that it would only be fair to yourself to give your chain a two-minute inspection once a week and thereby save yourself from possible injury?" "Well, I know you are right, as I have never given it a thought. I am going to take a squint at that chain right now, for now that I think about it I have made that little old chain do some work this while back." This is not to cast reflection on the ability or carelessness of these men, who just simply acquire a familiarity with their working surroundings and forget to be concerned in matters not dealing directly with the work. To make it a plainer statement, these men are more mindful to the material held in the sling than to the sling itself, which for the common needs of safety, in seeing that chains are kept in good condition.

Chain Inspection

Inspection of chains requires that an inspector becomes acquainted with the following duties. To inspect daily the condition of chains in the different departments, checking up those that show wear or abuse. Single leg chains checked up for undue stretch by their known length. Two, three or four leg chains are checked up by taking notice, when suspended on crane hook, that no one leg exceeds others in length. Care should be taken in making these chains that all sections are of equal length from the ring head. Where hard usage has caused noticeable dents or bent links, it is necessary that the chain be discarded and a new one applied; the long links as shown in A and B constitute the only part of chain allowed for smith-shop welding. The welding of any other link in chain leg is prohibited as further assurance of safety, not that there should be distrust of the welded link renewal but the general insecurity of other parts of the broken chain which may be strained. By renewing the entire chain leg there is no doubtful action taken.

Chain Identification

It is part of the chain inspector's duty to know exactly how many chains, and type, are in daily use. This requires that each chain have an identification number stamped on it, this to enable inspector to keep record of their use or abuse. Record of the same to be kept in card index or log book. This identification to read as follows: Number of chain, 50; kind of chain, double (plate hook); length and size, 6 ft. 0 in. x ⅝ link; where used, plate department; when made, 1—8—1918; last annealed, 3—6—1920; remarks, O.K.

Annealing Chains

The advisable practice is to anneal all chains semi-annually, especially those that are being used in continual and heavy service, as these develop a tendency to become crystallized. The method for this annealing is to put chains in a series of rows on the bed of the annealing furnace, one that is oil fired being preferred. With furnace closed up, gradually apply heat until chains attain a cherry red. Shut off the heat and allow furnace to cool until chains can be removed by hand. The inspector is then called upon to examine chains carefully, link by link, as this annealing invariably shows up seam fractures, that are indiscernible when chains are in use and oil coated. Chains inspected and found O.K. are then oiled. Large chains are brush painted, and the smaller chains dipped in oil tank and then allowed to drain off. They are then returned to their various departments for service.

A project to bring coal from the anthracite regions in Pennsylvania to New York through two 14-inch pipes, by water pressure, is being considered by the city Dock and Health Commissioners. This seemingly wild plan was submitted by Mr. Reginald P. Bolton, a member of the American Society of Mechanical Engineers. Mr. Bolton explained that between Scranton, Pa., and New York there is a fall in elevation of about 2,000 feet, and that it would be as easy to transport coal in this fashion as by water. He estimates that 7,000,000 tons of coal, which would amply supply the city's needs, could be brought through the pipes every year.

FIRE TUBE SUPERHEATERS SAVE 18% IN FUEL

Compare the cost of operating these three ships:—

	Ship A 200° S.H.	Ship B 100° S.H.	Ship C Saturated
Distance run (miles)	22,191	22,080	22,240
Coal per day (tons)	**37.8**	**45.3**	**46.1**
Coal per 100 miles (tons)	16.0	17.9	18.7
Coal per 100 miles (relative)	85.5	95.7	100.0
Cost of coal per 100 miles in dollars	**186.38**	**190.40**	**234.29**
Cost of coal per 100 miles (relative)	79.5	81.3	100.0
Mean working displacement	13,500	13,000	13,100
Coal per 100 displacement ton miles, lbs.	2.62	3.03	3.19
Coal per 100 displacement ton miles (relative)	80	95	100

These ships are identical in hull sizes, and run over the same route at approximately the same season of the year.

The Superheater Company, Limited

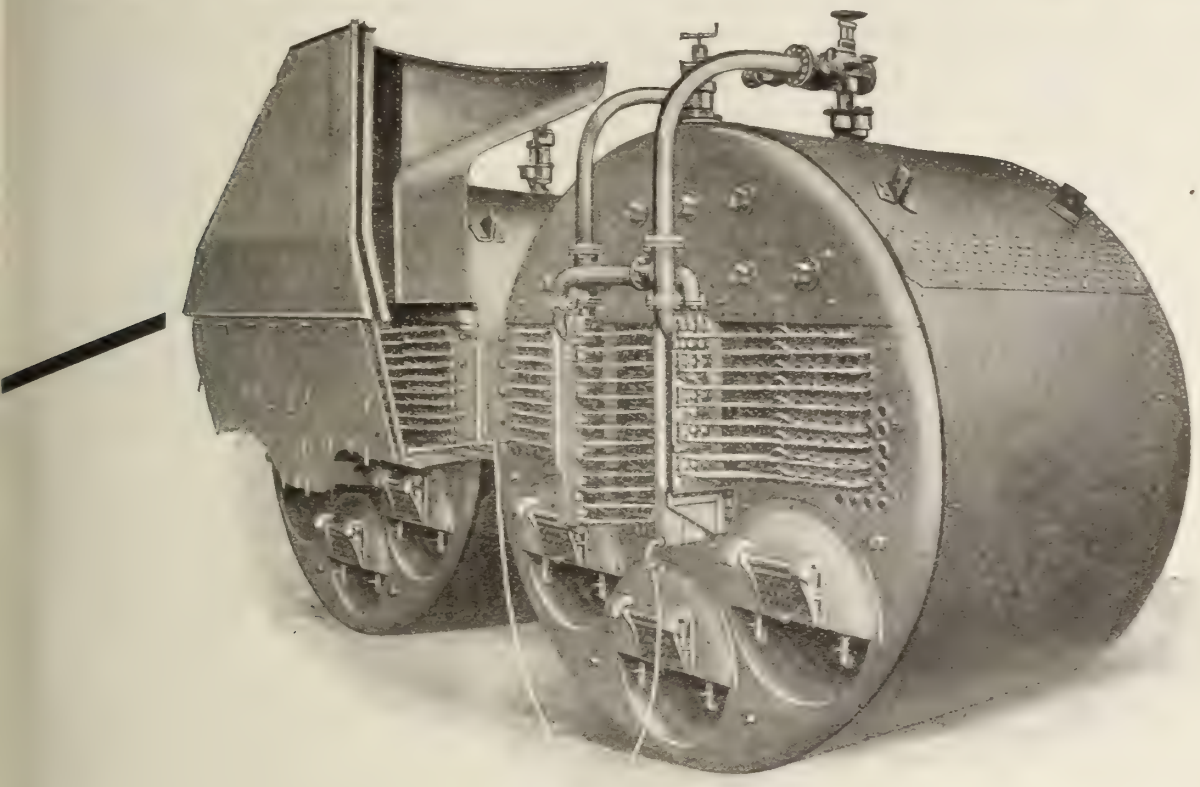
Transportation Building
MONTREAL

Works at SHERBROOKE, QUEBEC

B. C. Representatives: The Taylor Engineering Co. Limited, Vancouver.

Designing Engineers and Manufacturers of ELESCO Steam Superheaters and Pipe Coils for All Purposes

FIRE TUBE SUPERHEATERS SAVE $47.91 PER HUNDRED MILES



Fire Tube Superheater Installed in an Internally Fired Marine Boiler

All three ships are fitted with identical triple expansion engines and they have been free of any operating difficulties in the three or four years they have been in this service.

The highest economical performance of your ships is possible only when they are equipped with fire tube superheaters.

They can be easily applied when the ship is in port.

MADE IN CANADA

THE charter market has been quiet all winter, so far as Pacific coast ports are concerned, but there appears to be a general tendency towards more stable conditions, which are bound to result in better business and the movement of increased tonnage. Lack of cargoes, over-supply of tonnage and hesitancy on the part of shippers have been features of the situation, but there are unmistakable indications that an improvement is coming. It is the general belief among well-informed shipping men that the bottom has been reached and that the climb upward will be witnessed during the next few weeks.

Under present conditions British Columbia ports have a rather substantial advantage over United States Pacific ports in the matter of freight rates. This is largely the result of the disinclination of the Shipping Board to reduce rates to meet the competition. Shipping men in Seattle and Portland and other American ports have become so aroused that they have joined in a protest to Washington. Their attitude is set forth in a statement by James Grant, traffic manager of Falkenberg & Company, Seattle, running in part as follows:

"The rate on lumber from our own coast ports and Vancouver to the Orient is $15 a thousand feet," said Mr. Grant, who has been investigating the conditions in question for several weeks. "If a Shipping Board carrier loads lumber in Seattle, she charges $15 a thousand feet in American money. If she loads in Vancouver, she charges $15 a thousand feet in Canadian money. The difference of the rate of exchange between the two countries is 16 per cent. In reality the Shipping Board vessel carries the lumber from Vancouver at the rate of $12.60 in American money. When she changes the $15 Canadian into Uncle Sam's coin, that amount is all she gets for taking the lumber from Vancouver to the Orient.

"In effect, therefore, the lumber rate from Vancouver is $2.40 lower than the rate from Seattle and the other American ports in the northwest. As a result, we have little or no lumber moving from our own northwest ports while Vancouver has a substantial movement. The Vancouver lumber is cut by British Columbia mills and they reap the benefit of the difference in exchange. Our Shipping Board carriers certainly should be operated on a basis that would benefit our own American manufacturers instead of benefiting Canadian manufacturers at the expense of the Americans.

"If we cannot stabilize exchange at its old parity, we certainly should take some other measure to keep American cargo moving from Seattle and other American ports of the northwest on the same financial basis that cargo moves from Vancouver.

"The private American lines and the foreign lines follow the same rule as the Shipping Board carriers. They accept the freight charges from Vancouver in Canadian money. If the Shipping Board adopted a rule allowing the charges from the American ports to be cut to a point that would offset the difference in exchange, the other lines would probably have to follow suit.

"In any event, how is the new American merchant marine going to benefit the American shipper if it carries the products of another country for less than it carries the products of the United States?

"The difference in the rate of exchange is helping Canada at our expense all down the line in foreign trade. Freight originating in any part of Canada and going through Vancouver to the Orient pays its transportation charges, both rail and water in Canadian currency. Freight originating in the United States and going to the Orient through Vancouver on a through bill of lading must pay its transportation charges in American money. In the case of American manufacturing centres close to the Canadian lines it is possible, however, to ship the freight to a Canadian centre on the local rate and then ship from that centre to the Orient via Vancouver on a through bill of lading. In that case the through freight bill, both rail and water, would be paid in Canadian currency.

"For instance, Detroit can ship to Windsor, Canada, on the local rate, and thence forward its freight on a through bill of lading to the Orient via Vancouver, prepaying the charges from Windsor to the Orient in Canadian currency and thus saving 16 per cent. on the bill. The Canadian railroads naturally favor Canadian ocean carriers and thus we have a condition where American freight helps to support Canada's merchant marine instead of our own. In this instance, however, only those American manufacturing centres which lie close to the border are able to take advantage of the condition outlined.

"The handling charges and wharfage are the same in Vancouver as in Seattle —$1.55 a ton. The difference in the rate of exchange, however, actually makes the Vancouver charges 25 cents a ton less than in Seattle when you measure the amount in American money.

"Our own Washington apples have been moving to the Orient through Vancouver in considerable quantities because of the difference in the rate of exchange which more than offsets the lower rail haul to Seattle.

"The same conditions prevail as to imports."

The exceptionally open winter, not only here but further north, has had the effect of stimulating traffic northward. Already passengers are leaving for points inland from Skagway and even to Alaska.

The Harbor Marine Company, of Victoria, will probably be able to hand over the steel steamship Canadian Traveller to the Canadian Government Mercantile Marine by the end of February. This is the last vessel to be built by the company for Canadian Government account.

So far as the Canadian Government Mercantile Marine is concerned on the Pacific coast, the oil supply situation is no longer disquieting, according to B. C. Keeley, general agent, who has just returned from San Francisco, where he completed the consummation of new oil contracts.

The whaling industry will probably not be operative this season, owing to the general decline in oil prices. The Consolidated Whaling Company, with headquarters at Victoria, have decided not to send its fleet to sea, and the boats will be tied up at the wharves during the Summer.

The fleet of war vessels, recently assigned to the Canadian Government for service on the Pacific coast, is expected to reach Esquimalt about March 9, according to latest advices. After leaving Panama the fleet will make calls at Corinto, Acajutle, San Jose, Salina Cruz, Manzanilo, San Diego and San Pedro. A big reception for the fleet is being planned in Victoria and Vancouver.

It is reported that Japanese interests are booking fairly heavy orders for steel, and steel is regarded as a pretty fair barometer of the trans-Pacific freight market. Cotton is moving in limited quantities. Lumber has been slack, and a large proportion of the coast mills have been shut down during the winter months on account of market depression everywhere.

H. M. Scott, special representative of Peter Lyall & Sons, contractors for the big Dominion Government drydock to be constructed at Esquimalt, has arrived in Victoria to supervise preliminary operations, and actual work on the project will be commenced in the immediate future. Surveying at the Skinner Cove site is being proceeded with, and tenders for sub-contracts will shortly be let.

The popular opinion is that the day of high ocean freight rates is past. Steamship lines operating out of Pacific northwest ports have cut rates on lumber shipments to the United Kingdom and northern Europe. The rate for some time has been $45 and now it is announced at 225 shillings, which works out at slightly less than $40. Box shooks are cut from $1.65 to $1.50 per hundred pounds.

In line with lumber reductions on other cargo to the United Kingdom and northern European ports from Puget Sound are announced as follows: Canned salmon, strapped cases, cut from $1.62 to $1.25 per hundredweight; unstrapped cases, from $1.80 to $1.40; canned milk, tallow and fish oils, rates ranging from $1.75 to $2 cut to $1.25 per hundredweight. United States Shipping Board rates on grain have been cut from $18 to $16.

British Columbia fishing interests have received evidence from Japan that the concessions made to Washington D. Vanderlip were interfering with the rights held by the Russo-Japanese Fishing Company and the Hokuyo Fishing Company. These concerns have been negotiating with the Japanese Government for important concessions in the same locality as that ceded to Vanderlip. The minister of the navy, according to reports received here, has advised the companies to proceed, as they have prior rights.

The first indication of a movement by water of lumber from British Columbia to Eastern Canada is given in the case of a Seattle brokerage firm, which is seeking tonnage to carry 5,000,000 feet from Victoria or Genoa Bay to Quebec and Montreal. The call is for a steamer to take 4,500,000 feet to Quebec and a sailing vessel to take 500,000 feet to Montreal. The steamer is wanted for February-March loading and the sailer for March-April loading. In both cases the rate offered is $18. The same firm is offering $45, January loading, for a small shipment from Puget Sound to Delagoa Bay and Durban. Another cargo in the market consists of 800,000 feet of piles and lumber from Puget Sound to Jamaica, February loading, for which the shipper is ready to pay at the rate of $30.

The class of freight being shipped between British Columbia and New Zealand these days may be gauged from what the steamship Niagara took on her last trip from Vancouver. Included in the manifest were farm tractors, 777 bales of kraft paper, 44 rolls of kraft paper, 1,720 rolls and 351 bales of newsprint, 11 bundles and 504 cases of veneer panels, 478 crates and 160 cases of fir doors, 112 cases of printing paper, 371 bundles of roofing paper, 300 bundles of three-ply cottonwood, 1,080 bundles of cedar shingles, automobiles, 2,900 cases of canned fish and 5,479 boxes of apples.

The Victoria Chamber of Commerce is again making representations to the Federal Government for the creation of a free port area at Victoria, and it may send a delegation to Ottawa to press the matter. As a preliminary, a port commission may be appointed with a view to more efficiently organizing the facilities of the port. One of the principal objectives of the movement is to find more business for the big Dominion Government docks, which cost $4,000,000 and have been virtually idle ever since they were built, with the exception of a few months during the war, when they were utilized as a plant for assembling parts for wood steamships.

The ironworkers' strike at the plant of Yarrows', Limited, Esquimalt, was short-lived. When the company started work on the repair of the Grand Trunk Pacific steamship Prince Rupert, it put into effect a wage reduction of 50 cents a day. The ironworkers refused to work under these conditions, quoted figures to show that the cost of living had dropped only 60 cents a week, and declared that they would not return until the old wage was paid. The company was firm, however, and after the first ten days of the strike the men began to return. One hundred and fifty-five men returned February 1 and, with a full working force of 700 men, the plant is again operating at capacity.

It is probable that the Canadian Pacific Ocean Service will withdraw their two cargo-carriers, Mattawa and Methven, from the trans-Pacific service as a result of the steadily declining freight business. The Mattawa is already tied up at Hong Kong, awaiting developments, and the Methven, as soon as she completes her present westbound run, will also be tied up, according to F. H. Clendenning, head of the foreign trade department of the C.O.O.S. Officials of the company are naturally hoping that business will show improvement to a degree sufficient to justify continued operation of the freight boats, but the situation at present seems to be drifting from bad to worse. The Methven and Mattawa were brought from the Atlantic to the Pacific shortly after the armistice, and it was proposed to bring out a passenger liner, such as the Scandinavian, as well, but this latter plan was discarded in view of the expected early completion of the Empress of Canada.

It is reported that the Canadian Robert Dollar Company is again in the market for steamships and that the purpose of Melville Dollar, who recently left for England, is to purchase the vessels required in Great Britain. It is probable that with the acquisition of additional steamships the company will be able to substantially augment its service between the United Kingdom, New York and the Far East via the Panama Canal. If this plan is carried out it is likely that the additional link in the service would be maintained by two of the freighters, with an increase in trans-Atlantic service as the trade developed. Within the past two years Capt. Robert Dollar has purchased three freighters, the Esther Dollar, M. S. Dollar and Grace Dollar, totalling 52,000 tons displacement, and they are now on the regular run between the Orient and New York via Vancouver and the Panama Canal. The other vessels of the deep sea fleet are the Harold Dollar, Melville Dollar and Bessie Dollar. The Robert Dollar Company's Panama service has so far met with very satisfactory results, as Atlantic seaboard shippers are being convinced that waterborne shipments to the Orient are far more economical than those depending on the trans-continental rail haul, even though they may require a little more time.

As the result of an examination by the American Bureau of Standards of a large number of specimens of the steel deposited in electrically arc-welded joints it is stated that this metal has mechanical properties like those of an inferior casting. In tension tests the metal showed low ductility, and all of the specimens examined—about seventy in all—showed evidence of unsoundness in their structure, tiny inclosed cavities, oxide inclusions, and lack of intimate union. The conclusions reached are that this unsoundness is a necessary consequence of the method of fusion as now practised, and that it is responsible for the deficiency in ductility of the joint metal. Both a "pure iron" electrode and a low carbon steel electrode were used, with practically equal results. The composition of the material changed in fusion by elimination of carbon and other elements. The use of slight protective coatings on the electrodes did not appear to affect the mechanical properties of the arc-fused metal.

MONTREAL NOTES

AT a recent meeting of the St. John, N.B., Board of Trade the question of a Harbor Commission for the port was discussed by several members of the board and a large representation of the citizens. The meeting was in favor of taking some action in this direction and it is possible that a letter of request for consideration will be forwarded to Ottawa.

Th. Seidl, who has been away from Canada for nearly four years, is back again in Montreal, and will resume his duties as manager and chief engineer of the Escher Wyss and Company. C. H. Withers, who has been taking charge of the office in the absence of Mr. Seidl, will remain as assistant manager. Mr. Seidl is well known in Canadian engineering circles, having been in this country since 1911. For the past few years he has been in charge of the company's business in Japan.

The return of Roy M. Wolvin from England has, as yet, brought no announcement as to the future plans of the Dominion Steel Corporation, or the part the company will play in the proposed British steel merger. Pending further developments, the president has issued a statement, the substance of which is given in the following brief announcement. "Matters have not yet reached a point where any definite statement affecting the affairs of the Dominion Steel Corporation can be made." It is expected that a more concrete announcement will be made in a short time.

The success, in a small way, that has been attained by the Canadian Government Merchant Marine, in the carrying of passengers on their regular cargo steamers plying between Canada and the West Indies during the past season, has convinced the officials of the company that the venture should be a profitable and popular one, and to this end they will enlarge the service this season. The Canadian Fisher, the first vessel to carry regular passengers, will be followed by the Canadian Forester, and in due time a regular service will be maintained.

Capt. Percy St. John, until recently engaged in trading on the Atlantic coast for the United Fruit Company, has been appointed to the position of manager and secretary of the Montreal branch of the Navy League in Canada. Capt. St. John has seen fifteen years' service on the sea, serving with the Imperial forces during the war. Capt. H. S. Mathews, who has carried on the work of the Navy League in Montreal, for the past year or so, expects to take up active work at sea this coming season, on board of one of the Canadian Government vessels.

Walter Lambert, naval architect, 14 Place Royale, Montreal, is now getting prices from Canadian shipbuilders for motor barges, for carrying pulpwood, and specially designed to suit shallow draft conditions and for mechanical unloading. If prices are satisfactory, it is expected that contracts for these barges will be placed immediately, in which case ships will be in service in the St. Lawrence during the coming season, and being of special type will, no doubt, attract considerable interest. Mr. Lambert hopes at a later date to be in a position to publish plans and specifications of these ships.

Owing to the fact that the Aerial League of the British Empire has ceased to exist, and also to the continued interest of those associated with the development of aeronautics in Canada, it was decided at a recent meeting of the Montreal branch of the old parent league to continue to function under the name of "The Aerial League of Montreal." At this meeting, held early this month, an address was given by the Commodore, A. E. Tylee, outlining the past year's work, which included the establishment of the Montreal Air Harbor, and the outlook for future flying. Gen. Sir Arthur Currie was elected as president of the newly-formed league.

A point that may be of some considerable interest to Canadian exporters is the announcement made by officials of the Canadian Government Merchant Marine to the effect that freight rates on commodities leaving Canadian Atlantic ports for Great Britain have been reduced approximately 20 per cent. The rate per cubic foot has been reduced from 50 cents to 40 cents. The new rate of 75 cents per hundred pounds replaces the old rate of $1 per hundred pounds. This reduction applies only to Canadian export freight. Similar reductions have been made by other shipping companies, the percentage of reductions varying on different commodities, the range approximating from 20 to 25 per cent.

The congestion that has been experienced at the port of St. John, N.B., in past years, during the winter months, has been less evident this year, due largely to the lesser number of vessels arriving rather than to any increased facilities, although the latter to some extent have aided in better efficiency. Whereas in former years several ships would be anchored in the harbor awaiting a place to dock, this year every incoming boat has been able to get a berth immediately and unload and reload without any delay. This has been of special benefit to incoming immigrants. The new Government detention house, which has just been completed, will add greatly to the comfort and facilities for handling this class of traffic.

Owing to the low water that prevailed in the River St. Lawrence, below Montreal, during the late navigation period of 1920, the Montreal Board of Trade have had the matter up with the Department at Ottawa to see if something cannot be done to better these conditions. Towards the end of last season it was found necessary to issue instruction to masters of vessels to refrain from the full loading of their vessels. The importance of this situation was readily recognized by the Minister of Marine, as is seen in his communication, which is in part as follows: "This condition, I am informed, was mainly due to lack of precipitation and the very low level of the water in the Upper Lakes. With regard to the reference to further development of the St. Lawrence ship channel below Montreal, I need scarcely assure your council of the very deep interest that I have always taken in this project, both personally and as a member of the Government. It is my aim, as well as that of the Government, to continue to further development and improvement of navigation from Montreal to the sea to as great and rapid an extent as the circumstances permit."

Owing to the fact that the two first Government vessels built by the Halifax Shipyards have been registered in Montreal, the Halifax Board of Trade have filed a protest with the officials at Ottawa. Before these ships were launched it was stated that they would receive a Halifax rating, but when the Canadian Mariner was placed on the Montreal register an immediate protest was forwarded to the Government. Announcement was then made that the vessel had been registered at Montreal by mistake, but that succeeding ships would be registered at Halifax. However, when the second vessel, the Canadian Explorer, was registered it was at Montreal. A telegram was at once sent to Hon. C. C. Ballantyne and the board are now awaiting his reply. The Canadian Explorer has been given a very successful trial. This vessel is of 8,100 deadweight tons and of the design common to all other vessels of the same class. The Canadian Explorer will make her maiden voyage under the command of Capt. Wilfred Wyman, formerly with the Canadian Runner, with A. F. Day, recently with the Canadian Voyageur, as chief officer.

Operations at the plant of the Canadian Vickers Company have been proceeding satisfactorily during the winter months, but the activities have been somewhat quiet owing to the general easing up of business. Officials of the company state that they expect to have a vessel ready to put in the water towards the end of April or as soon as the river is clear of ice. This first launching will be followed by another about two weeks after. It was stated that the outlook for the coming year was fairly good, provided labor would take the proper view of the economic conditions and co-operate with the manufacturers in bringing about a situation that would insure steady employment, not only for shipyard workers, but also those in other lines of industry. Negotiations are now on for the securing of additional contracts, but shipping firms and prospective buying of vessels are reluctant to place orders for boats at the existing high costs. A proposition has been placed before the men at the plant with a view of revising the wage schedule, but nothing definite has been done in this regard. It is more than likely that the company will be successful in securing some good business if working arrangements are such as would enable them to lower quotations on the cost of constructing vessels.

NOTES FROM SOREL

The Department of Marine and Fisheries have authorized the necessary repairs to put the following craft in service:

Coal Barge No. 6.

Deschaillons—Service of lights and buoys.

Detector—Hydrographic service.

Frontenac.

Emilia—Fire-boat, stationed in the port of Sorel, in case of fire in the Government fleet.

James Howden—Attending dredges.

Lac St. Pierre.

Marine and Fisheries Dredges Nos. 1, 5 and 8.

Shamrock—Lights and buoys.

Reserve—General work.

Rock Cutter.

Varennes—Machinery outfit attending dredges.

Vercheres—Lights and buoys.

The Government Shipyard has now reopened after a few weeks' shut down. Mr. Louis Lacouture, who is the acting officer in charge, expects to be busy during the next few weeks.

The Transportation and Shipping Co. have started transferring their plant from the eastern to the western side of the Richelieu. The old site will be occupied by a pulp mill, to be established by J. H. Dansereau. The trawlers in course of construction at the shipyard of the company will be finished early this spring.

BOILERS OF SINKING SHIPS

By C. NORMAN FLETCHER

There is a wide divergence of opinion as to what happens to the boilers when a steamship sinks. Newspaper reports of sinking ships almost invariably state that the boilers exploded as the ship disappeared beneath the waves. The explosion of these reports is undoubtedly the large volume of steam generated when the incoming water reaches the boiler fires.

It is well known that the air compressed by a sinking vessel often tears up the deck, giving the semblance of an explosion and a much greater effect is only to be anticipated upon the liberation of very large volumes of steam in a confined space such as a ship's stokehold.

It may also be seen that should the boilers explode as the ship sinks the resultant damage would be so great that it would very considerably reduce the value of any subsequent salvage operations.

Another theory is that the incoming water cools the boiler exceedingly quickly, thus condensing the steam and causing a partial vacuum, which brings about the collapse of the boiler.

Modern marine boilers do not work at a much less pressure than 200 lbs. per square inch absolute, the temperature then being some 382 degrees Fahrenheit. Owing to the fact that the boiler is effectually lagged the incoming water will take some time to reduce this temperature.

Assuming that the vessel sinks in shallow water, say 100 feet deep. In the time taken by the ship to reach this depth it is unlikely that more than 100 degrees F. drop in temperature will take place.

This then gives us a temperature of 282 degrees F. and a boiler pressure of some 50 lbs. per square inch absolute. The difference in the volume of that part of the boiler which is filled with water before and after the condensation which will have taken place is less than 1 per cent. and may be neglected; 100 cubic feet of steam at 200 lbs. per square inch would occupy 370 cubic feet at 50 lbs. per square inch.

The heat given out by the condensation of some 5-7 of the steam is very considerable and will quite allow for the assumption of a temperature drop of 100 degrees F. only. The boiler therefore arrives 100 feet below the surface, with an internal pressure of 50 lbs. per square inch. The external pressure (absolute), of the water would be $.432 \times 100 + 15$ lbs. (atmospheric pressure) or $43 + 15 = 58$ lbs.

It is quite evident from the strength of the material used in a marine boiler designed to withstand 200 lbs. per square inch working pressure that an external excess of pressure of 8 lbs. per square inch would not cause collapse. Neither is there any likelihood of explosion.

Should the boiler sink to a considerable depth, then, of course, eventually total collapse would occur. It is, however, quite within the bounds of possibility that unequal contraction of steampipes and fittings due to varying exposure would cause fractures, in which case water would be admitted to the boiler before the difference between internal and external pressures wrought its destruction.

In reports of the sinking of ships the boiler is almost always said to explode about the time that the vessel takes her final plunge. This hardly seems to be borne out by investigation, which shows clearly that the boiler would collapse rather than explode.

NOTABLE TOWAGE FEAT

A notable towage feat ended successfully the other evening, when the Pacific Steam Navigation Company's liner, Huanchaco, safely delivered the oil tank vessel British Peer at Barrow, the port for which she was bound, after towing her 1,560 miles, says the Liverpool Journal of Commerce. It was on Jan. 2 that the British Peer wirelessed that she had lost her propeller and was helpless in mid-Atlantic. The Huanchaco, which was 70 miles away, picked up the message and at once diverted her course. It was then blowing a gale and considerable difficulty was experienced owing to the weather before the towage could commence. The weather having moderated, on the third attempt the Pacific liner managed, by means of a life buoy, to pass a line on board, and from this each ship, with tremendous difficulty and not before the next morning, managed to pass strong wire ropes one to the other, 60 fathoms in all. The tow then commenced with the speed dead slow, otherwise the hawsers would have snapped instantly. After struggling along, in very bad weather, there came a terrific gale on Jan. 14, when only the most patient and delicate humoring saved the tow ropes from being broken. After the gale had blown itself out, the weather took a good turn, and it was decided to go direct to Barrow.

It is perhaps worth recalling that in 1899 the New Zealand liner Waikato broke her tailshaft 200 miles south-east of Cape Town, and after drifting 2,200 miles was picked up by the Britsh cargo steamer Asloun and towed to Fremantle, a distance of about 2,600 miles. The towage lasted twenty-two days, three of which were spent under the lee of Amsterdam Island transferring coal from the bunkers of the Waikato to those of the Asloun. On Oct. 14 last year the Lloyd Royal Belge steamer Gasconier left Pernambuco towing the same company's disabled steamer Peruvier to the River Scheldt. The two vessels reached Flushing on Nov. 18, the total length of towage being 4,186 miles.

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Still In the Doldrums

THE world wide depression in shipping is still with us, and those who are best able to judge look for its continuance for some time. At the same time, the leading men in the shipping world, especially in Great Britain, where the shipping business is understood better than anywhere else in the world, are not taking a very gloomy outlook. They knew that a depression had to come, and during the prosperous days, laid aside a good portion of the earnings of their fleets so that they would be in a position to tide over the lean days that were inevitable.

Thus we see that Cunard Line is proceeding with its great building programme, just as if things were perfectly normal. This includes nearly 300,000 tons of shipping, as much as our whole Canadian Government Merchant Marine. The cancellations that have taken place have been those of purely cargo vessels, and some of these were for foreign owners. The Cunard Line, with their allied companies, have definite trade routes which they have been building up for years, and not only that, but they intend to hold the fields which they have been able to exploit owing to the disappearance of German shipping. Building costs must come down before the smaller owners, and especially the tramp owners, can afford to go on with tonnage they have in view. There are signs that before long there will be a more general understanding of the situation on the part of the men in the shipbuilding and engineering trades, and a calling off of the policy of hanging back.

As far as the industry in this country is concerned, there is no use in blinking the fact that the immediate future does not hold out any great hopes as far as building tonnage for export goes. There should be a certain amount of business to be secured in lake tonnage, a large amount of which was sent down to salt water and altered for ocean service, and for various reasons has not returned. This and the repair business should be able to tide the existing yards over till better times come. The weaker members have been pretty well weeded out, and those yards that do remain are in the hands of experienced shipbuilders and business men, who may be depended upon to keep their end up through the dark days.

Feeling the Pinch

THE United States Shipping Board are feeling the pinch of hard times and feeling it very acutely. At the last advices there were about 500 of their ships laid up and to those conversant with the shipping business this fact speaks volumes. Of course, the general public will have to foot the bill, but it looks as though those who were so badly in need of a merchant marine in the U.S. that they were willing to go to any lengths to get one have got a white elephant on their hands.

One result of this state of affairs has been a reduction in wages or a threatened reduction of $10 per month all round of the personnel of the fleet. As there are so many ships laid up it would seem as though the crews of those still running would have to take this cut with as good a grace as possible. Incidentally, this condition has also put a stop to the stealing of crews from foreign vessels in U.S. ports, which had become a source of much loss and annoyance to the owners of these ships. It will be interesting to see what takes place after the new administration takes office, as one of the President-elect's campaign promises was to enforce the Jones Act and generally do everything possible to make Columbia the mistress of the seas. So far her efforts have been productive of nothing more than a loss of money amounting to thousands of millions and the prospects in view of the state of the freight market are that there will be a few more millions to follow those already lost. Senator Wesley Jones and Admiral Benson must be doing a bit of wondering just at the present time. It was one of the most able of the Presidents of the U.S. that said the people could not be fooled all the time. That statement still holds good.

The Growth of the Motor Fleet

THE gradual development of the internal combustion engine as a marine motor is shown by the fact that in the last return of Lloyd's Register there is a separate classification for this type of vessel. The returns show that at the end of last year there were 189 vessels of 454,502 tons under construction that were to be fitted with this type of engine. Though winning its way into favor, and being gradually adopted by even the conservative shipowners, there is as yet no sign of any standardised design, such as the reciprocating steam engine has evolved. There is still considerable argument on the question of four cycle and two cycle, solid injection or air injection, and the best form of fuel pump regulation.

That the evolution of the internal combustion engine will be fairly rapid from now on is an assured fact from the number of engineers who are working on the various problems. The fact that there are such a number of vessels actually at sea with the various types fitted will be productive of a vast amount of information from a practical standpoint which is what is badly needed to help out the designer, who works from a purely theoretical angle. There is little doubt that in view of the necessity for economy, the internal combustion engine presents the most likely means of securing it. While British builders are somewhat behind at the close of the war in this particular field, they have made rapid strides since the armistice, and are now occupying a leading position in the development of this latest and most hopeful, from a thermal point of view, marine prime mover.

News of The Shipping World

THE position of the shipowner continues to be a hard one, and though it is pleasing to see that some optimism is still to be found, there is little real ground for comfort. The freight rates in general seem to have struck a long slide, the end of which is not yet in sight. Many shipowners are taking the unusual course of bringing their vessels home from abroad in ballast, the rates they are able to secure being so low that they are not worth while. More ships are being laid up, and it seems as though this drastic remedy will have to be carried farther before any change is seen. There is still a little coal being exported from the Northern Range ports of the Atlantic seaboard to Europe, but the rates are down to a very low figure. Antwerp or Rotterdam delivery is quoted at $5 and Northern Europe at $6 1-2, with $5 1-2 asked for coal to River Plate. Rates from Australia to U.K. ports which were quoted at 112/- and over a few months ago, are now down around 82/—. The easing off in the demands for space, or rather the large amount of space available for the tonnage to be shipped, has affected every market.

* * *

SIR ALFRED BOOTH, chairman of the Cunard Company, had some interesting remarks to make anent the revival of German shipping, during a recent interview. Speaking of the two extreme opinions held by different men in the shipping world, one of which is that Germany can never occupy her former position, and the other that she is almost ready to step back into it now, Sir Alfred thought that sober opinion should rest between these two extremes. "Up to a certain point Germany is bound, I think, to recover her shipping position; for while it is true that she has to start again from the beginning, it is also true that the beginning has already been made." In support of this assertion Sir Alfred pointed out that there were now nine German shipping lines trading between North and South America, Mexico, Dutch East Indies, India, Scandinavia, Cuba, Antwerp, and even to England. He also drew attention to the alliance between Germans with experience and no ships, and Americans with ships and no experience. He also asked the question: Will she succeed? and proceeded to answer it in these words: "We hold the field, and it is our intention to occupy permanently at least a portion of the field which was open to Germany before the war. So far as we and other British shipping lines can do this, the recovery of the German shipping will be definitely kept in check. Our organization is ready; all we need now is the ships, and the Cunard is building them."

* * *

THE Mackenzie River will be the scene of much activity when navigation opens again according to advices from Edmonton. Notwithstanding the rescinding of the oil regulations, there will be a great amount of material and supplies to go in. The Hudson's Bay Co. are building a new boat and refitting their old fleet, and a number of scows are being built at Fort McMurray. The company have not only all their own supplies to take up the river, but have contracts with the Imperial Oil Co. and the Canadian Government, and these will tax their equipment to its full capacity. The Hudson Bay Co. are building the scows at Fort McMurray for the survey branch of the Department of the Interior and they will be towed from there across the Slave Lake and down the Mackenzie to Providence, from where they will drift down to Fort Norman. There will be 45 men accompanying the scows, and 50 tons of freight in the Hudson Bay steamer in addition. There will be also two parties on the Peace River near the Chutes, while the deputy minister of mines will also take in four parties. The Imperial Oil Co. will take in three new drilling rigs, and 600 tons of supplies.

THE British Columbia Express Company, which had quite a history, has been absorbed by a new company to be called the Alberta and Arctic Transportation Company. The new company will start a service to link up the Peace River with the new oil fields with the opening of navigation. The new company has also taken over the stock and equipment of the Lamson and Hubbard Canadian Co., Ltd., which formerly operated boats on the Peace River. They also owned a tractor equipment for hauling supplies over the portage between Fitzgerald and Fort Smith on the Slave River, besides warehouses, sawmills, docks, gasoline launch, etc. The new company will also build a steamer in time for the opening of navigation. Their fleet will include this new steamer, the steamer D. A. Thomas, built by the late Lord Rhondda, the steamer Hudson's Hope, both on the Peace River. The steamer, Slave River, will be on the Athabasca, and the steamer Distributor, which was built last year at Fort Smith and made two trips down the Mackenzie River to Fort Norman. The old British Columbia Express Company was started during the famous gold rush to the Caribou in the early 60's, and operated from the head of navigation at Yale on the Fraser through the northern part of the province. The company, following the construction of the C.P.R., operated from Ashcroft up to recent years. The new company will transfer its operations entirely to the northern waterways of Alberta.

* * *

MR. SCHWAB, one time chairman of the Emergency Construction Board in the U.S. and also chairman of the Bethlehem Steel Corporation, has been giving his compatriots some good advice on the disposal of their ships. "Don't throw good money after bad, but bow to the inevitable force of economics," is his dictum. The reason of his remarks is the fact of over 500 vessels of the shipping board being tied up, and those operating privately have in many cases gone into liquidation. Truly Columbia's effort to rule the waves is not prospering these days. The Government is most anxious to get out of the shipping business, but cannot find any private firm to relieve them of their white elephant. The only hope would seem to be to dispose of what tonnage they can at any price they can get for it, and take the loss, which could be put down to war expenditure. It is proving abundantly evident even to the fanatics who have control of the shipping board that a mercantile fleet cannot be created and operated on a commercial scale by mere acts of Congress. There is no reason why Americans should not be in the shipowning business and make a success of it in the same way that shipowners of other countries do, but there will never be any measure of success achieved by the passing of legislation framed with a view to wiping other shippers off the face of the waters.

* * *

IN connection with the above statement it is a fact that the ships under construction for the Cunard Company are being proceeded with, although cancellations have been made of ships for their allied lines. A vessel that was building for the Donaldson Line at Vickers', Barrow-in-Furness, has been cancelled after a considerable amount of work has been put in on her. On the other hand some firms of shipbuilders have had contracts postponed rather than cancelled completely. There seems to be a feeling, as evidenced by press comments in Great Britain, that there is a turn in the long lane as far as costs are concerned very near at hand. With a general downward revision, there would be a great renewal of activity, and a good many of the contracts recently cancelled would be taken up again. The fact of the matter is that there are many owners who have not yet brought their fleets up to the required standard in point of numbers, and who would do so if they could build them at a reasonable cost. As it is, they cannot hope to have ships that can earn their living if built at the present rates.

SPEAKING about building programmes, the first of the thirteen ships which the Cunard Line are adding to their fleet sailed last month from Liverpool to New York. This vessel, the "Albania," expresses well the new idea in mixed cargo and passenger vessels. She can carry 480 passengers, all of one class, and these fortunate individuals have the run of the ship, there being no spaces blanked off to one or other. In addition to this passenger list, she can carry 11,000 tons of cargo. She is an oil burner, and will be eventually in the London, Canada, and New York service, her first sailing from London to America being set for March 8th.

* * *

AN interesting paper was read recently before the Institution of Engineers and Shipbuilders in Scotland by Mr. C. O. Liljegren, entitled "Coal Oil or Win." Mr. Liljegren showed by means of charts that there were certain definite eras of low prices, which occurred in fairly regular cycles. In these periods, he claimed, the machinery driven vessel was impossible to operate at a profit. He advocated the introduction of a motor clipper, built on scientific lines, which could accomplish voyages at an average speed that well compared with the purely machinery driven vessel, and whose cost of operation would be much lower. The paper was well reasoned out, and it is our intention to publish it completely in a subsequent issue.

* * *

THE various organizations of navigating officers and pilots in the Dominion have now been gathered together under one banner. The new society is called the Canadian Navigators Federation, and its consummation is largely due to the efforts of Captain W. L. Gilchrist, of Nanaimo, B.C., who was at one time the presiding officer of the Canadian Merchant Service Guild in B.C. There will be four main divisions of the new society, the Eastern, St. Lawrence, Central, and Pacific. These divisions, while working under the constitution of the main body, will be perfectly free to look after their own internal affairs. Among the different bodies which attended the conference at which the new society was formed were the Canadian Merchant Service Guild of the Pacific, the Canadian Merchant Service Guild of the Great Lakes, the American Association of Masters, Mates and Pilots, the Shipmasters' Association of Halifax and the Maritime Provinces, and the Pilots' Association of the St. Lawrence. The organization will be entirely Canadian in character, and will be open to all those holding British or Canadian certificates.

A STORY of a rather unusual happening is reported in the British press. A steamer called the "Oak" went ashore on the rocks near Millbay, on the island of Anglesey. The crew went ashore, and during the night the vessel of her own volition floated off, and drifted toward a small islet known as the West Mouse. Here she was sighted by a Liverpool tug which was bound up channel, and the tug scenting salvage, made haste to get a line aboard the ship. She had barely succeeded in doing this and taking the vessel in tow when the crew arrived in a small boat. The captain of the tug refused to allow the crew to board their own steamer, knowing or surmising that did he do so his salvage claim would be likely to degenerate into one of ordinary towage. The tug took the steamer into Holyhead, and her crew were picked up by another steamer and brought into the same harbor.

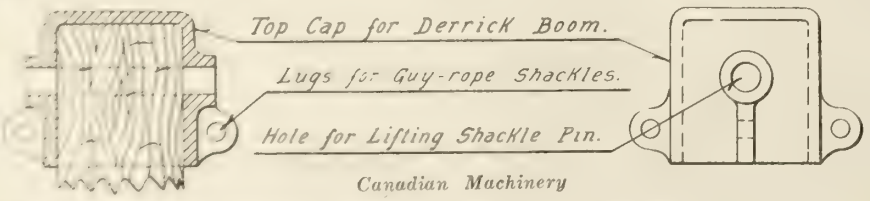
* * *

THE liquidators of the Three Rivers Shipyard Ltd., a subsidiary of the National Shipbuilding Company (an American concern), have indulged in some very plain speaking in their report. The assets of the company are placed at $930,335 while the liabilities are $3,095,126. The explanation for the failure of the yard is that it was organized and conducted by men without the necessary experience to make a success of it. Following is the report, or that part dealing with the causes of failure:

"The whole story of the organization of this company," says the report of the liquidator and trustees, "indicates lack of proper financial and technical foresight. Apparently none of the executive officers or directors of the two companies appear to have had sufficient previous experience in shipbuilding, and seem to have undertaken tremendous contracts and operations without any proper regard to capital, costs or consequences. The contracts which this company had could never be executed with any degree of profit and certainly cannot now, and reports from those who were in a position to know demonstrate that shipbuilding in Canada as an industry will be dormant for some time to come. This is borne out by the fact that other yards are either closed down or are in liquidation. The yard in Three Rivers as an eight-way proposition in any event would not have been successful."

The report is signed by National Shipbuilding Corporation (in bankruptcy); Three Rivers Shipyards, Limited (in liquidation); Gordon W. Scott, of P. S. Ross & Sons (liquidator); Paul L. Turgeon, of Chartrand & Turgeon (authorized trustees).

Size in Ins	8 x 8	8 x 8	8 x 8	8 x 8	9 x 9	9 x 9	9 x 9	9 x 9	10 x 10	10 x 10	10 x 10
Length in Ft	40	50	60	70	40	50	60	70	40	50	60
[illegible]	4700	2500	1800	1300	6400	4100	2800	2100	9700	6200	4300
[illegible]	10 x 10	11 x 11	11 x 11	11 x 11	11 x 11	12 x 12	12 x 12	12 x 12	12 x 12	14 x 14	14 x 14
[illegible]	70	40	50	60	70	40	50	60	70	50	70
[illegible]	3200	14300	9100	6300	4700	20200	12900	9000	6600	24000	14000
Size in Ins	15 x 15	15 x 15	16 x 16	16 x 16	17 x 17	17 x 17	18 x 18	18 x 18	20 x 20	20 x 20	
Length in Ft	50	70	50	70	50	70	50	70	60	70	
[illegible]	32000	16000	45000	22000	52000	27000	65000	33000	69000	50000	



Canadian Machinery

DERRICKS

Safe Load on Beams

By G. Wilson

Derricks should be kept under cover, but not in a place that is too dry. They should be packed from the ground so that air can circulate all round them. The top cap should be as shown on sketch. Note this table is for pine derricks with flat ends, and the square is taken at the centre of the derrick.

Out To The Boy

In connection with the stay of the Bahia Castillo, a Canal employee has contributed the following impression to the Panama Canal Record:

In your dry official way you will state in the Panama Canal Record that the Australian troopship, the Bahia Castillo, passed through the Canal on December 31, en route from London to the antipodes with a passenger complement of 520 people. That will be your utterly prosaic statement of this event—the habitual manner of speaking of similar happenings. But you need to sit on the hatch of the vessel somewhere down there where you will be surrounded by the second class and third class passengers; need to show yourself as possibly a bit more human than is your ordinary manner before you can know much about this particular trip of the Bahia Castillo. This is better exemplified if you have a wee bit "cuttie" growling in your pipe, a tendency to permit the kiddies to sprawl over and round you without molestation—a slight burr-ish accent will help, and you'll be a human magnet among them if you can manage to refer casually to the "bloomin' hather." For it's that way with them—they're largely kin to one Bobbie Burns.

A first impression of them is a somewhat pathetic one; but it rubs off readily. You feel more and more pathetic as you go down and down from the main deck to where they really are. Arrived there, and properly ingratiated, it is forgotten. It doesn't matter so much that they're closely quartered, uncomfortable a good bit; and that they're sort of "by-and-large" crowd, some of the kempt with the unkempt, so to speak. A crowd of your own making couldn't be different—you wouldn't really want it to be.

It is far from carnal to let your eye guide you as among them. It's just human. You could tell those lassies who are going out on the great adventure to the antipodes as though they were resplendently labelled; tell them down on the lower decks of the Bahia Castillo just as well as though in de-luxe surroundings. In fact, they'll tell you themselves. I sort of like that; I think you would. It's better for the world that way. That's why, in a momentous way, that this trip of the Bahia Castillo can not be stated officially; it's a "bridal special," en route from maidenhood in England, Scotland, and thereabouts, to glimmering, glittering, resplendent, rosy-hued matrimony in the celestial antipodes. Too many words? Not a bit. You would say it just that way yourself, sitting there on the lower hatches among them and letting the spirit of it soak into you. I digress to say, not as an alienist but as a human, that something's wrong with matrimony unless there's just about this degree of enthusiasm attached to it.

Incidentally, they are going out to Australia and New Zealand; primarily, they are en route by the quickest possible passage to "the boy." I don't know why in every case he's "the boy"; but if he's that to them, it's all right with me; if you refer to him as "fiancé," that's all right, too. As an interviewer, one would not succeed among them in attaining any idea or description of "the boy." In letting them interview you, one comes to know that he is Scotch, English, Australian, New Zealander, Canadian, American (in remote cases), as may be; you're compelled to believe that he's a prince of a chap, that in most cases he came over to fight the Hun and succeeded in having shot at least one arrow without fiendish intent. All wars have this saving incident. And the war note is made more dominant in this case by the fact that Wilhelm, once of Imperial notoriety, furnished the Bahia Castillo to the British Commonwealth; not willingly, nor for a bridal ship.

No Scotch lassie, nor English lassie gushes; not even over "the boy." I like that, too. Right away you arrive when they tell you about him; not without a good degree of enthusiasm jumbled up with some fine pride, to be sure; but wholesomely. I found him to be all manner of men. It was hard to imagine that one among them, yclept affectionately as "Tommy," would find a farmer lad and a marriage license awaiting her at Tasmania. But even so. It seemed good to me that he wasn't an "agriculturist," nor a "rancher," just a farmer; and, bless you, it was all right with her. quite all right. Others equipped with marriage licenses would be "cl-a-rks," railroad men, all kinds of them. It is best for the world that way.

Few bridal specials are sidetracked, fewer dry-docked; and no roseate hue is reflected from the side walls of Balboa dry dock, not if you are strictly analytical as to surroundings. Likewise if you are five weeks out from home with five weeks more to go before you get to "the boy," quite reasonably you become aggrieved; by synchronous stages you arrive at peevishness of the disagreeable sort, when your "Special" is delayed. This may have existed with them; but it was not in evidence. Closely, and in many instances rather disagreeably, quartered and surrounded, they were taking the inevitable with a fine and saving grace. You caught that, if nothing else, from them. They clung with their fine native intensity to the main objective. Brides, either de-facto or prospective, assume, too, certain rights, as I have known them; the essential one being that they are entitled to the best; not second or third class facilities in travelling, to be sure. They reflected a different, even a better concept of it, these lassies from the bairns and dells and downs. It was best exemplified when they sang one of their own home songs, "I've a Wee Bit Hoosie Waitin'." Passage money is the same as any other money, they had no hesitancy in admitting it; and "the boy" was to have some little thrill of pride when he discovered that she had willingly chosen cheaper passage than he had provided, wasn't he? Homes, and nations, and worlds are not better founded than on these lines.

Reluctantly I turn from the brides to note the "others present." Chiefly there were families in process of reassembling. Wives and children returning to their homes, the kiddies bearing up well under the strain of a long and tiresome voyage; husbands, army officers, civilians, and interspersed here and there an entire family voyaging out to a new world. A homogeneous assemblage of 520 crusaders, such as no nation other than Britain furnishes. Many similar voyages pass us here. By a turn of fate the Bahia Castillo becomes distinctive, and accentuates something of a world service not ordinarily accredited to the Panama Canal, difficult in the analyzing, intangible in accomplishments; but the human influence measured in units not connected with traffic reckoning. Ours is not, to be sure, the only route, but it is worth while that we get them home somewhat quicker and maybe a bit cheaper; worth while, too, that now and then they tarry a bit with us, and reciprocally the clans have the opportunity of commingling.

The wisdom of the world frets and fumes in an attempt to adjudicate the differences of mankind; instinct, without wisdom, concludes that the best antidote is the enhanced intimacy of the peoples.

SAILING CRAFT GOING

The latest available figures show a remarkable declension in the sailing craft now afloat on the world's oceans. The old windjammer seems at last to be steadily slipping away into the limbo of dead things, says the Dolphin and Guild Gazette. Taking vessels over a hundred tons burden, within a period of eight years the roll has fallen from 7,099 to 5,082, and the gross tonnage represented has decreased by about one million and a quarter tons. It appears to be a general symptom, irrespective of flag flown. In 1912, of sailing ships the British Empire possessed in commission 1,430, the United Kingdom 755, and the United States 1,558. The respective figures in 1920 are: 1,052, 448 and 1,316. Nevertheless, in spite of a falling total of sailing ships, the U.S. ensign floats over an actually increased number. Americans are building large iron and steel windjammers still. Fewer than a hundred large ocean-going sailing ships now fly the British flag. The submarine and the war boom in sea carriage brought a passing flicker of life into sails, but the present slump in freights once more brings oblivion within sight.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

NO. 2 MAXIMILLER

The Kempsmith Manufacturing Co., Milwaukee, have placed on the market their No. 2 plain maximiller. This machine is of similar design to their No. 4 size and has the same balanced weight, rigidity, convenience of operation and efficiency in production. Its size adapts it to the medium heavy classes of automobile and aeroplane work, and it will also be found valuable in tractor, steam turbine and agricultural machinery plants. The very highest class of materials obtainable are used. All gearing stock is purchased to exact chemical analysis and is scientifically treated for the particular use to which it is put. Much of the shafting, especially that in the speed train, is also heat-treated alloy steel.

The column, knee, saddle and table, which constitute the main frame numbers, are of semi-steel, and have been carefully designed in regard to relative weight and strength. An exceptionally large area of base provides stability for the entire machine. No weight whatever has been added merely to have a heavy machine. Every pound of metal used is well placed, and serves a useful purpose.

The knee is of the solid top design, there being no openings whatever in the top plate of the knee. This construction serves to better resist clamping strains and the torsional effect of the table overhang. The side walls of the knee are practically solid, there being but two small openings, which are closed by plates. Cross-feed screw is located in a shallow depression in the top of the knee midway between the saddle V's. The greatest possible strength and accuracy is the result as the pull or thrust of the cross-feed screw is applied to the centre of the saddle.

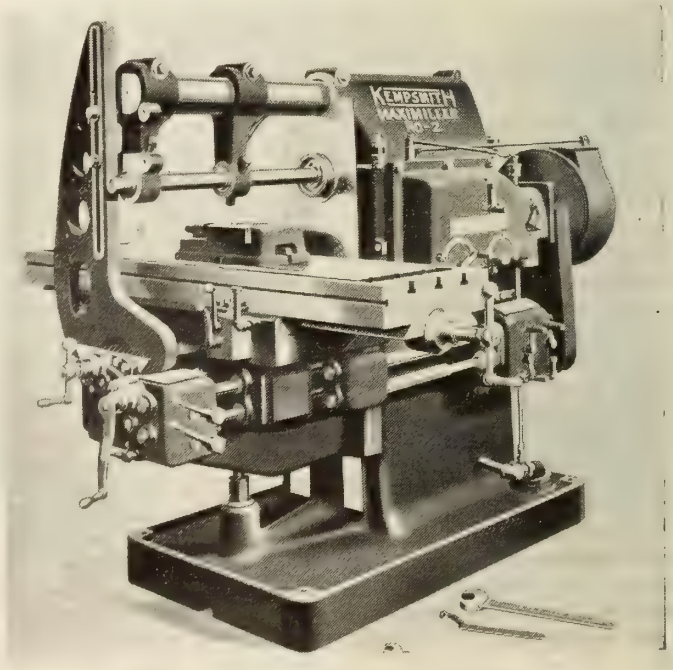
Column is well ribbed internally and has very few and small openings. The reservoir for the speed drive oil forms a solid rib or cross member midway of the column height, which has a great stiffening effect on the column. Saddle is long, heavy and rigid. Drive to table is located near end of saddle, which leaves the center solid where the most strain comes. Table is 12 inches wide with 56 inches working surface in length. Table gib is of adjustable taper type with locked adjustment.

The overarm is a solid steel bar 4¼ inches diameter and is a patented "wedge lock" type which keeps the arbor in alignment with the spindle at all times. The spindle hose is of patented type which provides for driving face milling cutters in either direction and also permits cutters to be quickly and easily removed. Right hand design has been used which means that normal direction of spindle rotation is correct for standard drills and boring tools. A spindle reverse has been incorporated in the machine for the reason that in order to get cutting strains in proper direction on gibs and tables a face mill must be run in the opposite direction to a spiral or slab mill.

The clutch is of friction plate type operated by a hand lever located at the front of the machine where it can be easily reached by the operator. Friction surfaces of clutch are large in diameter and are forced together by a combination toggle and plain lever movement which gives the required pressure on the plates with very little effort on the operating handle. Clutch is adjustable for wear without dismantling the unit. A brake operating on the reverse throw of the clutch lever overcomes the momentum of the spindle gear train and stops the spindle quickly.

The drive pulley is 15 inches diameter, takes 3½ inch double belt and runs at 400 R.P.M. It is mounted on ball bearings and with the clutch is enclosed in a protecting housing. The control of the longitudinal movement is by two levers, one for the feed and one for the power quick traverse. The operator merely pushes the one required in the direction he wishes the table to move. The knee and saddle movements are both controlled by a second set of levers, the unit which shall move being determined by push pins located in close proximity to the respective hand feed handles; while feed or quick traverse is determined by which lever is pushed. Operator can control the movement of the table in any direction either by power feed or quick traverse without moving from his position at the front of the knee.

The cooling system is a part of the machine. Pump is of the centrifugal type driven through a clutch which can be disengaged if the nature of the work does not require the use of a cooling fluid. The capacity of the pump is about 15 gallons per minute delivered to the cutter. Lubrication of all working parts has been given careful consideration in the design of the Maximiller. The gears and bearings in the entire speed and feed mechanism run constantly in oil and are lubricated by splash. The only exceptions to this are the sight feed oilers



GENERAL VIEW OF THE NO. 2 MAXIMILLER

used to supply fresh clean oil to the spindle bearings and drive pulley. The lubrication of all mechanism supported by the knee is centralized at two points which make it certain that none will be overlooked.

The spindle is very large and runs in phosphor bronze bearings which are easily adjustable to compensate for wear. All other shafts in the speed transmission run on ball bearings. The entire spindle drive is located in an oil tight case and runs in oil. Feed change mechanism provides 18 changes of feed ranging from 5-8 inch to 25 inches per minute in geometrical progression. The gears are all heat treated steel and run in an oil bath.

Quick Traverse

The power quick traverse is available for all table movements without disturbing the set up for whatever rate of feed may be in use. The available feed rates remain constant, but power quick traverse rate has been reduced for the cross and vertical feeds to compensate for the short travel distance of the former and the greater load in the latter case. The longitudinal power quick traverse, is at the rate of 100 inches per minute while the cross and vertical travel is at the rate of 36 inches per minute. Oiling directions for this machine are simple and complete, a small plate on the speed box being all that is necessary to explain them to new or unskilled operators.

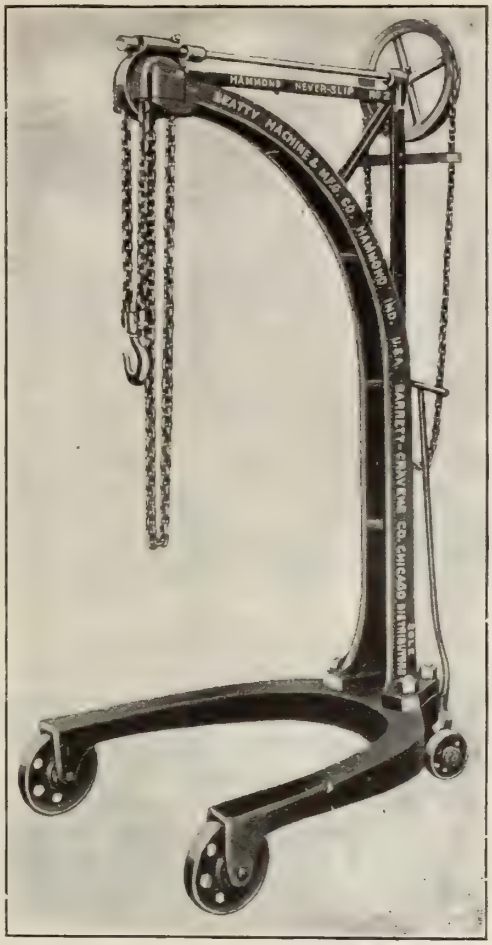
The drive is of the single pulley type through a train of gears giving 18 changes of spindle speed ranging from 16 to 400 R. P. M. All speed changes are secured by sliding gears, there being no tumbler gears, clutches or locking pins. There are never more than three pair of gears in mesh. All heavy cuts are driven through the large spindle gears, the gear arrangement being such that all cutters above 3 inches diameter are normally driven through this gear. When desired and at an extra cost we can furnish the above machine arranged for motor drive through belt in which case the motor recommended is 7½ H.P., running at 1,200 R. P. M.

PORTABLE CRANE

The Barrett-Cravens Co., Chicago, Ill., have placed on the market a portable crane which is claimed to have various outstanding features.

The crane is of all steel construction, and the load is locked at all points of travel. The lifting mechanism is of the worm and gear type, thus allowing the load to be raised to any desired height, even to a fraction of an inch. This is, of course, a desirable feature when assembling or dismantling heavy machinery.

The hoisting worm gear is made of bronze, and the screw is cut from solid steel shafting of goodly proportions.



GENERAL VIEW OF THE PORTABLE CRANE.

Both are enclosed in an oil tight cast housing to permit proper lubrication. The axle is chrome nickel steel, heat treated, and Hyatt roller bearings are used in all the wheels. The treads of the wheels are chilled to ensure long wear. The Ontario representative for this concern is the Anglo-Canadian Metals, Ltd., 52 Spadina Ave., Toronto, while B. and S. H. Thompson & Co., Ltd, 210 McGill St., Montreal, handle the other provinces in Canada.

DRILL ATTACHMENT FOR MILLERS

The Purves Manufacturing Company of Syracuse, N. Y., are placing on the market a special attachment for the drilling of holes in work carried on the table of the milling machine. The fixture is so designed that the work may be located on the table without the use of a jig and the holes drilled to any desired angle by swinging the attachment to the required position. A small hand lever is provided for feeding the drill, this method giving a more sensitive control and aiding materially in preventing drill breakage. The feed lever may be placed in different positions to accommodate various shapes of work. For depth drilling adjustable stops are provided.

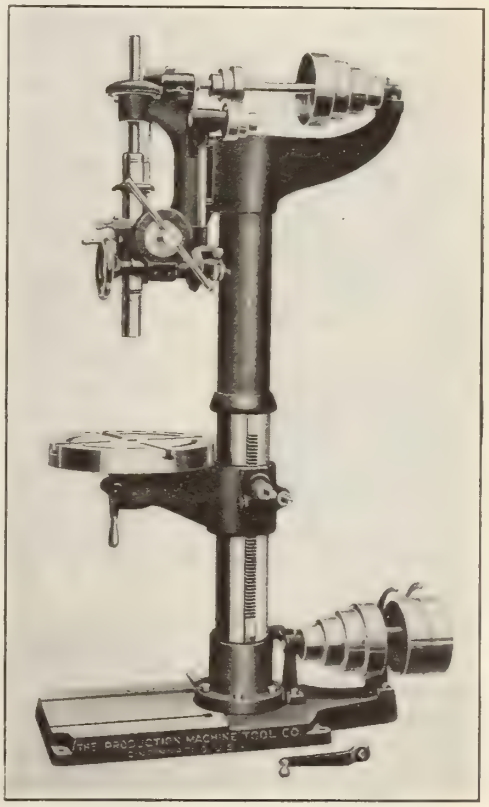
22-INCH UPRIGHT DRILL

The Production Machine Tool Co., Cincinnati, Ohio, have placed on the market a new 22-inch upright drill. This machine has stationary head, bronze bushed throughout. It is built to do the regular type of drilling, boring, tapping, and facing work up to its range of 1¼-inch diameter drill.

The machine is regularly built with power feed, but this can be omitted if desired. Back gears, and tapping attachment can be added together with the type of drive best suited to conditions under which machine has to be used.

The frame is of ample proportion. The column is of tubular section, and if sufficient stiffness to withstand all strains. The table arm is a single casting and of box construction. The table is well ribbed, and has four tee slots of the same size as those in the base. Four radius slots are also provided. All other parts are proportioned to withstand heavy usage.

The drive is by means of tight and loose pulley through driving cones of large diameter and wide face. The driving level gears have a peripheral speed of less than 800 feet per minute. The spindle sleeve is bronze brushed, and the spindle has a suitable ball bearing for thrust. Four spindle speeds are obtainable on the plain machine, with four additional speeds through back gears.



THE 22" UPRIGHT DRILL PRESS.

AN OIL LIGHTING SYSTEM

The Rand System for bunker oil provides a highly effective method of reliquidizing oil in ships' innerbottoms without any of the disadvantages that attend the use of heating oils.

This system applies forced circulation to the bunker oil by means of a central heater located in the boiler or engine room connected to a circulating pump (usually the transfer pump), and with discharge and suction connections at the deep tank and innerbottoms. Each lot oil discharge connection consists of a nozzle constructed so as to slowly rotate in a horizontal plane, thereby causing agitation in every direction throughout the mass of cold oil in the tank compartment. These nozzles are installed through an opening cut in the tank top and in the case of vessels already built, this can be done and the entire system installed without removal of oil from the innerbottom tanks. The deep tank connection is used to start the system and where the vessel is not fitted with deep tank or settling tank a specially designed bulkhead connection is furnished to provide an auxiliary for temporary use in starting.

So effective is in the Rand System in assuring complete circulation and effective reliquidizing of the oil that an innerbottom tank 90 feet long has been handled with two discharge nozzles, one at each end of the tank. The exact number and location of the nozzles, as well as the determination of the capacity and arrangement of the system are matters of special engineering for each installation and are decided after a thorough investigation of the plans and fuel requirements of the vessel considered.

The principal advantages of the Rand System are as follows:

1. Circulation and effective reliquidizing of the oil are assured by the constant inflow of hot oil through the rotating nozzles and the constant withdrawal of cold oil to the heater.

2. The temperature of the oil can be positively controlled either manually or thermostatically, so as to prevent overheating and partial destructive distillation with loss in fuel value of the oil.

3. The system provides a flexible control of the oil temperature to meet changing conditions of sea-water, weather, or grade of oil used. The circulation can be increased or decreased by changing the pressure of the oil at the nozzles and the temperature of the oil can be increased or decreased by changing the steam pressure in the heater.

4. A uniform temperature is maintained throughout each tank compartment, preventing any strata of congealed oil from diminishing the effective tank capacity.

5. There are no heating coils or other equipment in the tank compartments to reduce tank capacity, contaminate oil through leakage, increase maintenance cost through rapid wear and difficulty of repair, or overheat the oil.

6. The entire system (except the discharge nozzles), is outside of the tank compartment, in plain view, and readily accessible.

7. The system makes use of existing pipe connections and pump and can be installed at comparatively small cost and without removing oil from the ship's innerbottom. Repairs and replacements are normally few and readily made.

8. There need be no guesswork as to elements of design or arrangement of the system, because the circulation of oil which it produces is known to be positive and governed by definite calculations.

Row & Davis, Engineers, Inc., are the sole agents for the Rand System in the United States.

NAVIGATION ON THE GREAT LAKES

The current issue of "Agricultural and Industrial Progress In Canada" contains the following interesting narrative from the pen of M. McD. Duff, manager of the Great Lakes S.S. Service of the C.P.R.:

The Great Lakes, those wonderful bodies of fresh water, possess a charm which never fails. To those who know them, the charm increases with lengthened acquaintance, and the newcomer's first visit is never the last. Unfortunately, however, even on this continent in the territory east and south of their natural boundaries, they are soon forgotten once the school geography is laid aside.

To the scientist, their physical history is fascinating and they tell us that aeons before the lakes were lakes, their present basins were drained by mighty rivers, those from the upper lakes finding their way by the present southeastern end of the Georgian Bay, past Lake Simcoe (almost the line of the Trent Valley Canal), crossing the Lake Ontario boundary about twenty miles east of Toronto, then joining with the branch from the Lake Erie basin near Rochester, N.Y., and on down the present St. Lawrence Valley.

Niagara is painfully young. The original river used the Dundas Valley and the present Burlington Bay. About thirty-two thousand years ago, when the lakes began to approach their present outline, there was no connection to Lake Erie from the Upper Lakes, whose waters found their way through Lake Nipissing and the Ottawa Valley over the route of the proposed Georgian Bay Canal; and it was only some twenty-four thousand years later that they broke through to the Erie Basin and Niagara approached her present grandeur. Possibly, in another five or six thousand years, Niagara may have vanished and the surplus water escape by the Chicago drainage canal.

Early History

Champlain first visited the Great Lakes in 1615, using the Ottawa River, Lake Nipissing and French River route. The history of the next two centuries is filled with brilliant records of exploration, education and evangelization by the French, and particularly by the Jesuit Fathers, whose heroism and devotion is appropriately marked by the names they have left: Sault Ste. Marie, Isle Royale, and Duluth, all widely known. The fur trade developed slowly but surely, hampered as it was by never ending warfare between the Indians and French, French and British, British and Americans, until the Treaty of Ghent brought mutual disarmament and American and Briton settled down, in 1815, to a century of peace.

The first vessel to ply the waters of the upper lakes was the "Griffin," built by La Salle in the upper Niagara River in 1679. Although she was launched in May, it was not until August that they were able to get her over the swift water and on to Lake Erie. She had a very short career, for her first voyage was never completed. She got as far as Lake Michigan, and after loading a cargo of furs, set sail on the return voyage 18th September, but was never heard of again. Her size is not certain, but is variously estimated between 45 and 60 tons burden.

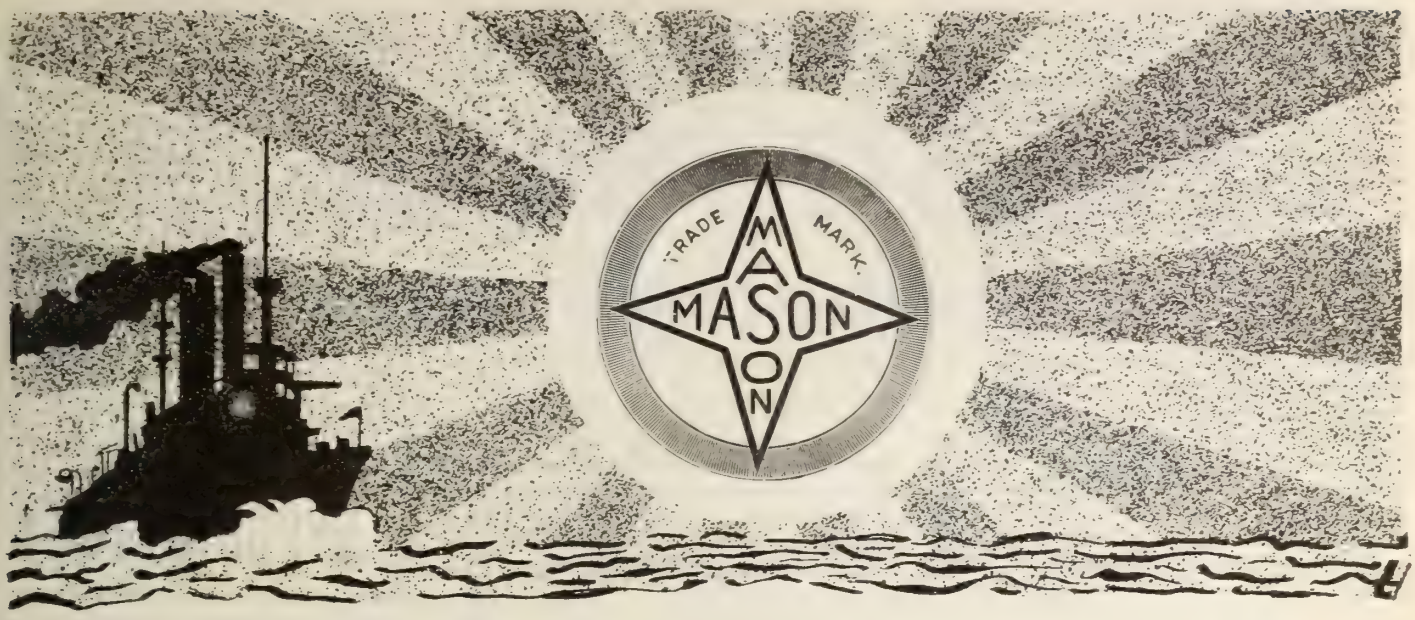
From this little craft to the present ballast freighters which lift 12,000 tons of ore or half a million bushels of wheat, is a long cry, although the development of lake navigation was a very slow process until the close of the war of 1812, and up to which time the limit size was 100 tons. There was, however, great expansion on the conclusion of the war. The tide of commerce gradually flowed westward from Lake Ontario until the first canal at the Soo was opened in 1855, and Lake Superior began to come into its own.

The First Steamer

The first steamer was the "Ontario," launched in Lake Ontario in 1816, to be followed two years later by the "Walk in the Water," which opened steam navigation on Lake Erie; from that time onward, steam rapidly replaced sail-power, until today a sailing vessel is a rare sight on the lakes. Up to 1830, there were only eight steamers on the Great Lakes, the largest being the "Superior," which measured 346 tons. Building was very rapid from 1830 on. The "Michigan," launched at Detroit in 1833, was the largest, and had sleeping accommodation for 108 passengers. The steamer "Great Western," commissioned in 1839, was the first vessel to have passenger accommodation on two decks, and during the time she was building, grave doubts were expressed as to her seaworthiness. These early steamers were all wood burners.

As the tide of immigration flowed westward to Illinois and Wisconsin, the demand for passenger accommodation became so great that a daily service was established between Buffalo and Chicago.

These passenger boats were all fairly fast, making the trip from Buffalo to Chicago in from three to four days, counting, of course, time of stoppage at way ports and time lost in fueling. The



MASON
MARINE SPECIALTIES

In the Limelight of Satisfaction

Mason Appliances are in the foreground to-day for dependable service. The Mason trade mark is recognized by engineers everywhere as the symbol of satisfaction and the mark of highest quality. This satisfaction is based on the fact that every Mason device is designed to give reliable service even under the worst conditions. Mason Specialties are carefully made by Canadian workmen and only the best of materials go into their construction. If you need marine equipment of proven worth choose Mason. It's your guarantee of service better than the ordinary.

We are sole makers and distributors in Canada of the Marine goods originated and developed by

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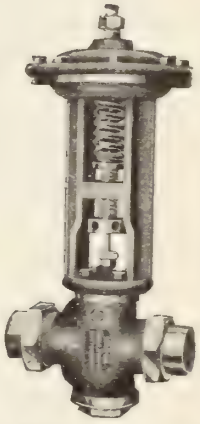
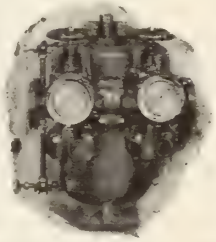
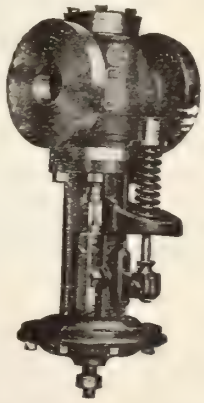


Mason No. 55 Style Pump Pressure Regulator



Reilly Multi-screen Feed Water Filter.



Mason No. 126 Style Marine Reducing Valve

passenger boats were all side-wheelers and handsomely fitted up, in some cases elaborately decorated.

The year 1850 marked the height of the side-wheel passenger traffic. At that time there were sixteen first-class steamers between Buffalo and Chicago, two boats leaving each port daily, and while passengers offered, they were profitable, four to five hundred passengers per steamer being not unusual. The building of the railroads, however, gradually cut the business away, until by 1860 side-wheeler boats were practically out of business; the passenger business had gone, and they could not compete in freight service with the less expensively operated screw-propelled vessels.

The First Propeller Boat

The first propeller boat was the "Vandalia," 138 tons, built at Oswego in 1841. The first steam propeller vessel on Lake Superior was the "Independence," which was launched in Lake Superior in 1846. At that time there were only four so-called ports on Lake Superior, and the landings were made from anchorage in small boats.

It is interesting to note that the side-wheeler passenger boat is eventually coming back to its own. The very fine passenger steamers operating between Buffalo, Cleveland and Detroit are all of this type.

The first merchant iron vessel was the "Merchant," built at Buffalo in 1861. From that time, iron and steel rapidly replaced wood. In the eighties, the "Onako," 281 feet long, was considered a marvel, having carried 110,000 bushels of corn, the greatest cargo on record, until in 1897 the "Amazon" took 230,000 bushels.

The size has increased year by year, until today we have the "Grant Morden," 604 feet long, which has carried close to 750,000 bushels of oats. The deepening of harbors and river channels, the increasing size of the Soo canal, improvements and aids to navigation in general, coupled with rapidly increasing traffic, have made this possible, and where a few years ago it was necessary to use one, two, or even three tow barges to a propeller in order to move a profitable quantity of freight, today this necessity is gone.

The Whaleback Appears

The whaleback made its appearance in 1889, but has now practically disappeared. They were fit only for bulk cargoes, were very uncomfortable for crews in rough weather, and with the improvement in the channels, their one advantage of carrying a large load on a light draft has disappeared.

The present type of bulk freighter has been developed to meet the requirements of limited draft and rapid handling of bulk cargoes, and has been improved from year to year, until the latest vessels are admirably adapted to moving traffic at a minimum of expense and time, and also to meet general conditions of lake navigation.

The seagoing car ferry and the ice-breaker are both types which have been especially developed on the lakes. When the Trans-Siberian Railway was being built, the Russian Government sent a commission to study the working of these icebreakers, and the ferries they built for service across the Siberian Lakes were duplicates of those in service across the Straits of Mackinac. The handling of railway trains on car ferries was recognized as a specialty during the Great War, and a corps of car ferry men were recruited on the lakes to handle the ferrying of cars across the English Channel.

The Modern Lake Fleet

While the Canadian Pacific Railway was building, the work of construction was much slower along the rocky shores of Lake Superior than it was from Fort William westward across the prairies. To bridge the gap, the company built three steamers in 1883 on the Clyde. They crossed the Atlantic under their own steam, were cut in two at Montreal, towed up the canals in sections and rejoined at Buffalo. They operated between Owen Sound, Port Arthur and Fort William, and besides general merchandise carried a great deal of material which went into the construction of the Western Section of the railroad.

The "Algoma" was lost in 1885, but her engines were recovered and put into the "Manitoba" when built in 1889, and are still giving good service. The "Alberta" and the "Athabasca" were lengthened in 1911 and 1910, respectively, and are still in active service. The "Assiniboia" and the "Keewatin" were added to the fleet in 1907, and, although they have been surpassed in size, are as yet unequalled in seaworthiness and comfort.

Henry Beatty Built Early Fleet

The original boats were built under the supervision of Mr. Henry Beatty, father of President E. W. Beatty, of the C.P.R., and so well were they planned that notwithstanding their age they are still, as package freighters, equal to anything on the lakes.

NOTICE TO MARINERS
No. 1 of 1921
Atlantic No. 1

All bearings, unless otherwise noted, are true and are given from seaward in degrees from 0° (North) to 360°, measured clockwise, followed by the magnetic bearing in degrees in bracket, miles are nautical miles, heights are above high water of ordinary spring tides, and all depths are at low water of ordinary spring tides.

NEW BRUNSWICK

(1) Bay of Fundy—Northwest of Campobello Island—Buoys Discontinued

Former Notice—No. 76 (203) of 1918.

Buoys Discontinued.—The two red conical buoys placed by United States authorities in 1918, northwest of Campobello Island have been discontinued.

N. to M. No. 1 (1) 22-1-21.

Authority.—Departmental records.

Admiralty Charts.—Nos. 2020, 2013, 352 and 1651.

Publication.—Nova Scotia and Bay of Fundy Pilot, 1911, page 286.

Department File.—No. 11350.

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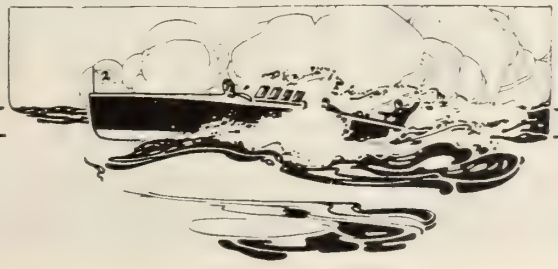

Marine News From Every Source

Vancouver.—The Hon. C. C. Ballantyne, speaking at Vancouver, said that eventually many more millions would be spent on the harbour, in addition to the five millions which would be devoted to the Government pier.

London.—The shipping returns issued by Lloyd's Register show that Great Britain is once more leading the world in the building of ships. Out of 7,179,000 tons under construction at December 31, Great Britain had 3,709,000 or 51.6 per cent. of the total.

New York.—The International Marine Corporation propose to add to their fleet to the extent of ten new steamers at least during the next sixteen months. The ships, which will be put on the North Atlantic service, will be built for the Leyland Line, one of the companies forming the combine.

Vancouver. — Canadian Government Merchant Marine plans include a service to the Orient from Vancouver, the first sailing to take place on March 15, according to B. C. Keeley, the general agent of the line for the West Coast. A service between Vancouver and South Africa was also contemplated, said Mr. Keeley, and it was possible that Montreal and Vancouver would be joined by a service via the Panama Canal.

Toronto.—A conference took place at the Queen's Hotel here which may portend interesting happenings in the marine field. The gentlemen present were: J. A. Paisley, Cleveland; Gordon Silcox and Robert Burke, of the same city; H. L. Ferry, Hamilton; C. B. Nienebar, Fort William; C. S. Watts, Minneapolis; and O. S. McFarland, Milwaukee. These gentlemen are in close touch with Mr. Playfair, of Midland, and the meeting is said to be in connection with some new steamship services.

Detroit.—There are signs of activity on the Detroit water front, and a general expectation of an early opening of navigation. It is thought that by the end of the month St. Marys River will be clear of ice and that by the middle of March all floes will have disappeared. Local navigation between the two Soos is expected to start almost any time. Meanwhile workmen are busy painting and overhauling gas buoys and other aids to navigation, ready for an early start.

James McGill, engineer on the Steamer Mallon, of the Matthews Steamship Company, whose home is at 44 Smith Street, Toronto, died at Cornwall on January 31, from injuries receiving by falling into an open hatchway on the vessel.

Kingston.—The steamer Chamberlain, recently damaged by fire, has been sold by Captain Harry Martin to A. A. Laroque of the McNaughton line. Capt. Martin has also sold the barge "White Friant" to R. C. Weddell, Trenton, for the coal and stone trade.

Montreal.—The Canadian Government Merchant Marine has taken delivery of the Canadian Victor, built at the plant of the Canadian Vickers Co., Montreal. The vessel is of 8,400 tons, and will load for Liverpool. The line to the Far East will be opened in the immediate future by the departure of the Canadian Pioneer.

Washington.—The U.S. Shipping Board has authorized increased freight and passenger rates on the Great Lakes, to be made effective after one day's notice not later than January 1st next. The freight rates are enabled to be increased by 40 per cent. and the passenger rates by 20 per cent. It is expected that the vessel owners will put the new rates in force without delay.

Brockville.—The work of lightering the cargo of the stranded steamer Phelan at Iroquois Point is proceeding rapidly. The Donelly wrecking fleet has about completed this work, 32,000 bushels having been removed, and the work of pumping out the wet grain is now being proceeded with. The grain is being loaded into barges, the dry and wet being kept separate.

Goderich.—One of the oldest captains on the Great Lakes died recently at Goderich in the person of Captain Alexander Lawson. The deceased gentleman was 77 years of age and had been both a master and owner of sailing vessels on the Lakes. The last vessel he owned was the "Two Brothers," and he retired from active business about ten years ago. He was one of the original stockholders in the Hutchinson Flour Mill, which is now the Western Canada Flour Mills Co. The funeral was held with Masonic honors.

Big Season's Work.—It was announced on February 19, by Mayor Church, after a conference with Finance Commissioner Ross and Chief Engineer Cousins of the Harbor Commission, that they hoped to do between two and three million dollars worth of work on the Toronto Harbor during the coming season.

Officials of the Canadian Government Merchant Marine recently announced a general reduction in cargo rates on goods and materials leaving Canadian ports for Great Britain. The new rate will be 40 cents a cubic foot, or 75 cents per hundred pounds. This is a reduction of about 20 per cent. over the rates formerly in force.

Captain Fatally Injured. — Captain Kenneth McKenzie, of Tiverton, was fatally injured at his home in Tiverton, nine miles from Kincardine. He went down into his cellar to look at the acetylene plant, which had not been working properly the night before, and it is surmised that he lit a match, for there was a heavy explosion, and part of a match was found on the floor. He was found with his skull crushed in and both arms broken. He died as he was being carried upstairs.

Liverpool.—With the departure from Liverpool of the White Star liner "Vedic" recently something new in Atlantic travel was inaugurated. This is the one class liner, the class in question being entirely third. The accommodation is for 1,200 passengers, and the general scheme of decorations and the comfort provided are far above anything yet done for the comfort of those who cannot pay the high passenger rates in the first class liners. Care has been taken to arrange for the different nationalities to keep to themselves, and especially at meal times, where different customs might be objectionable to one party or another.

The Yarnall Waring Co., Chestnut Hill, Philadelphia, have issued a supplement to their bulletin B-410 showing the Yarway Junior seatless valve. This valve, which is made on the same general lines as the Yarway seatless blow-off valve, has been developed for purposes such as blow down valves on water columns, soot blower service, and engine and turbine drips. It is made in the angle and straight way types.

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At the Worthington-Snow Holly Works at Buffalo, N. Y., the Worthington All-American Marine Oil Engine, 2400 I. H. P., has just completed a successful 30-day run.

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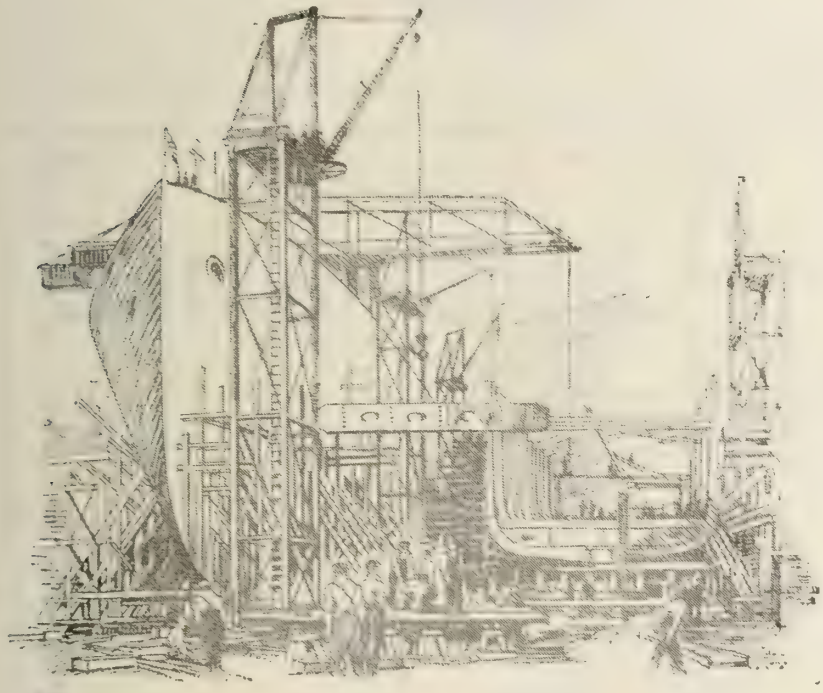

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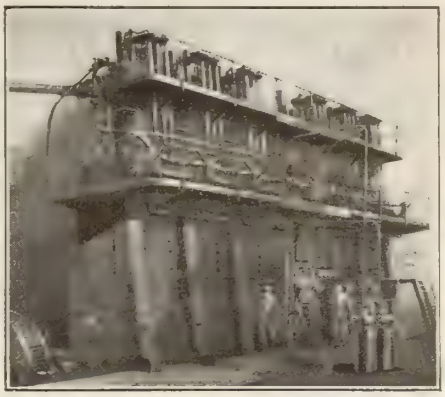

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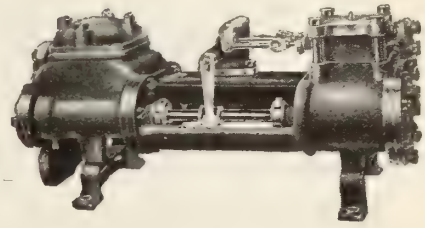
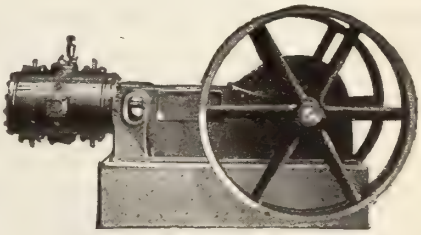


Duplex Packed Piston Pump



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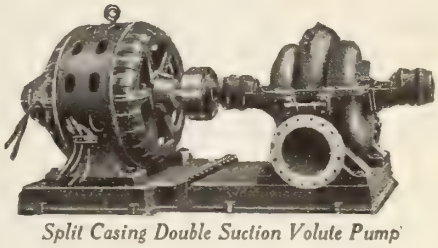

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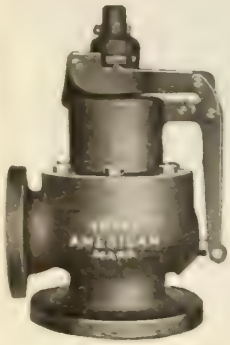

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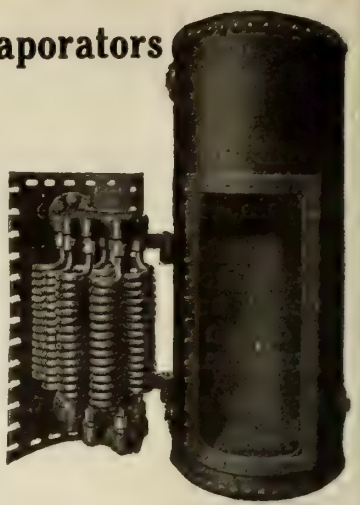

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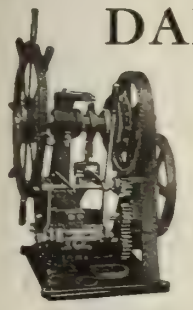

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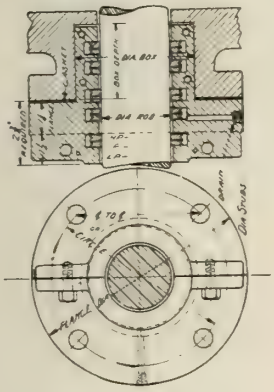

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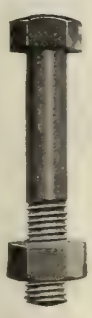

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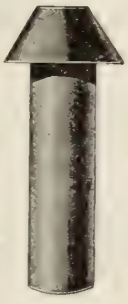

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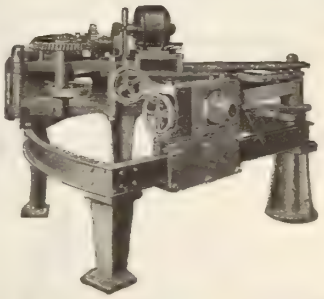

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Fun at Opening of Parliament

J. K. Munro sat in his seat in the Press Gallery, Monday, February 14, when Parliament opened, and looked down with the good-natured tolerance and contempt of an iconoclast and a satirist at the proceedings. The members invariably amuse "J. K."; it takes a really big man to elicit more than scant praise from his sophisticated pen. His March 1 article is entitled: "Funny, as the Owl is Funny."

Other Big Features and Fiction

"Canada's Fur Future," by Agnes C. Laut. Telling what a potential gold mine Canada has in her fur industry, properly conserved and exploited.

"Goldwin Smith," by James Mavor, Ph.D. The personal side of the "Sage of the Grange," the man who was tutor to King Edward VII, before coming to Canada.

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"The Man Who Knew Too Much: The Bottomless Well," by Gilbert K. Chesterton. This Near-Eastern well and a revolving bookcase figure in a baffling murder story, handled by England's master of fiction.

"The Lady at the Door," by Barker Shelton. A girl takes a law course, graduates—but that doesn't mean clients. But she gets a partner—and for life.

The Millionth Chance," by Henry Holt. An adventurous sea story, with a girl skipper and a man who won her respect—and even her love.

Review of Reviews

Split Among the Socialists— Joseph Gollomb

New Wonder City— Agnes C. Laut

Where Humanity Started— New York "Times"

World's Worst Failure?— Harold Trowbridge Pulsifer

Birth Control and War— Harold C. Cox

A Pugilistic Apollo— Heywood Broun

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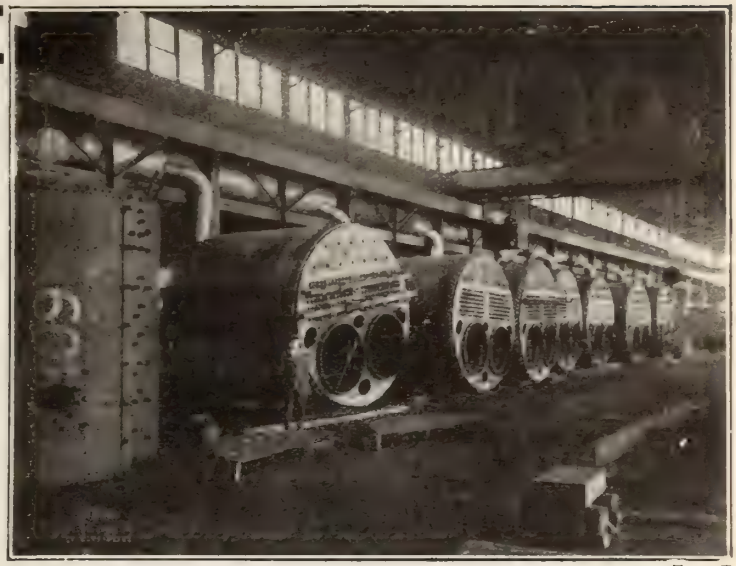

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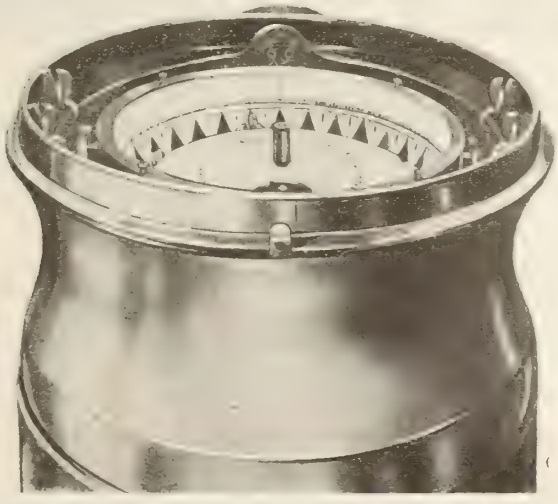

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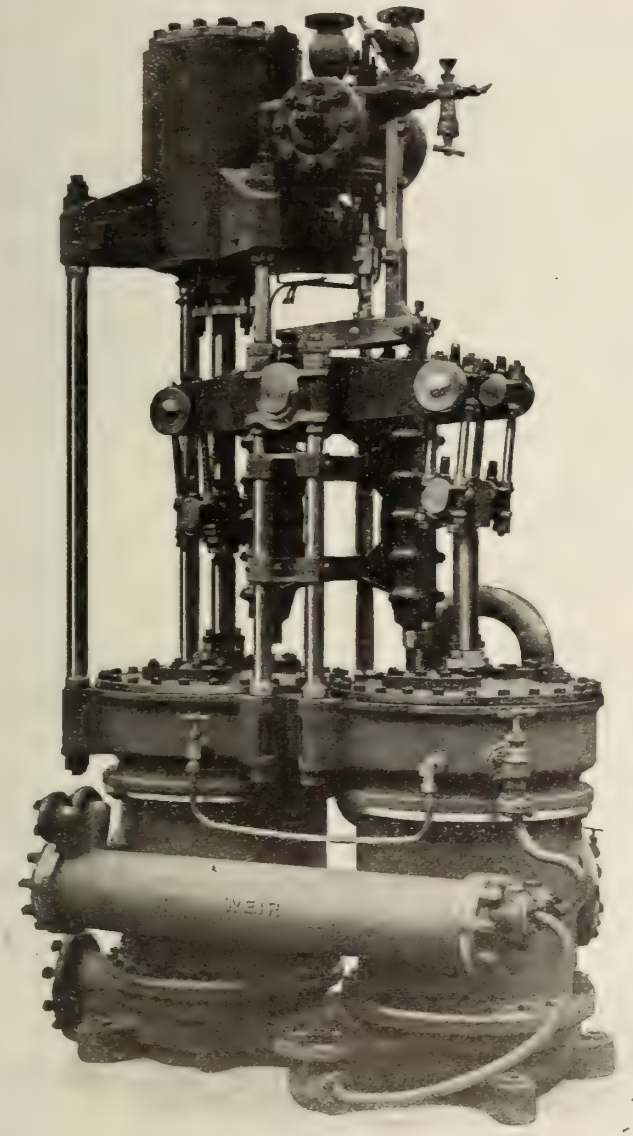

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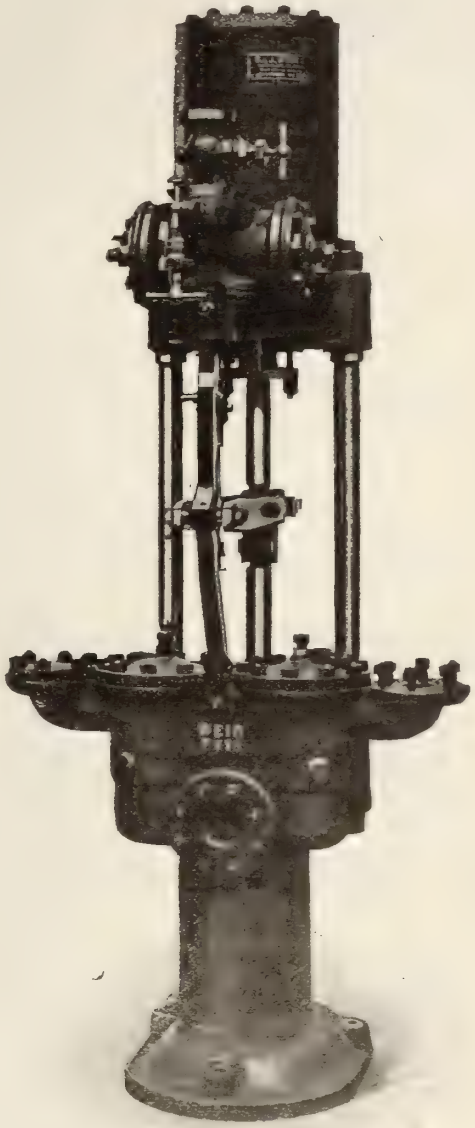

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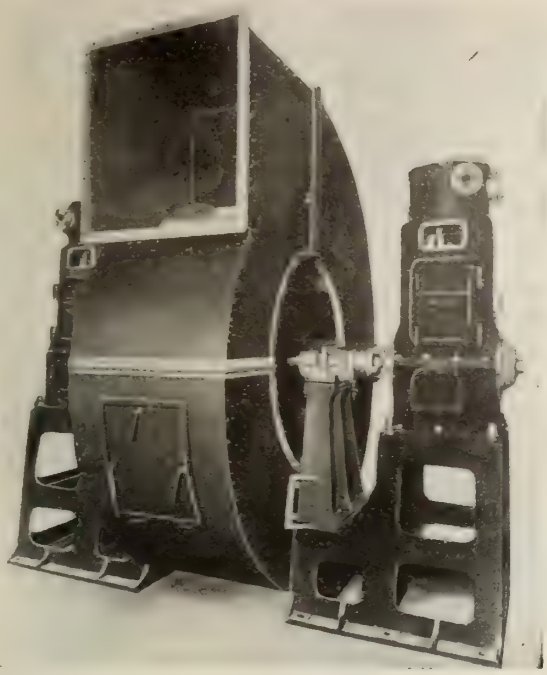

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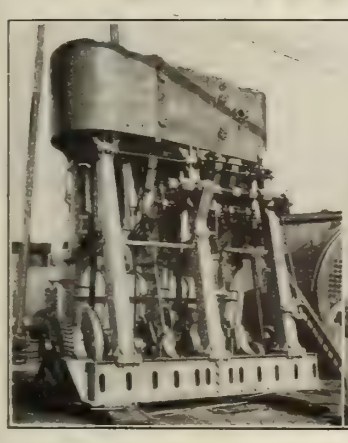

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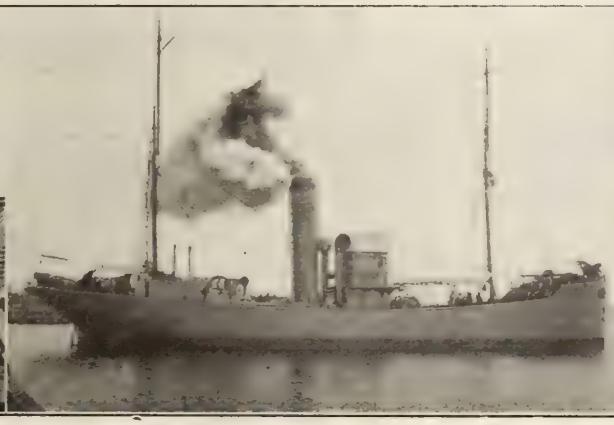

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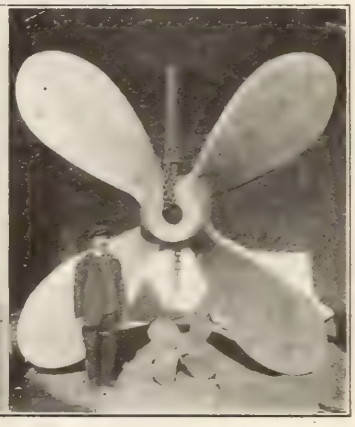

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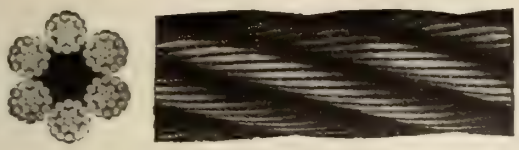

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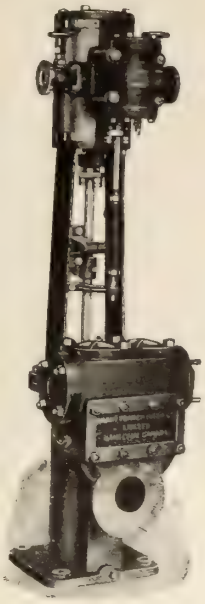

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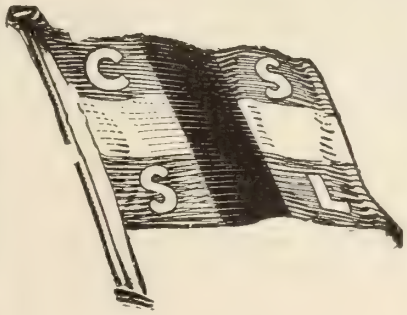

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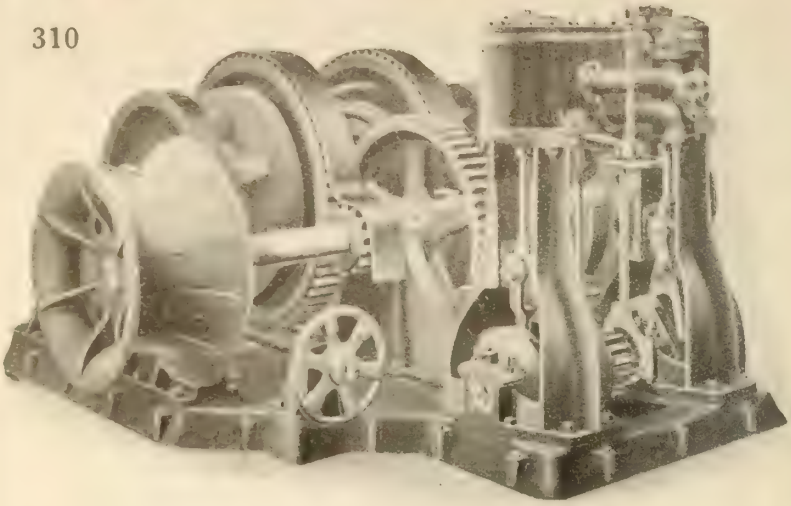

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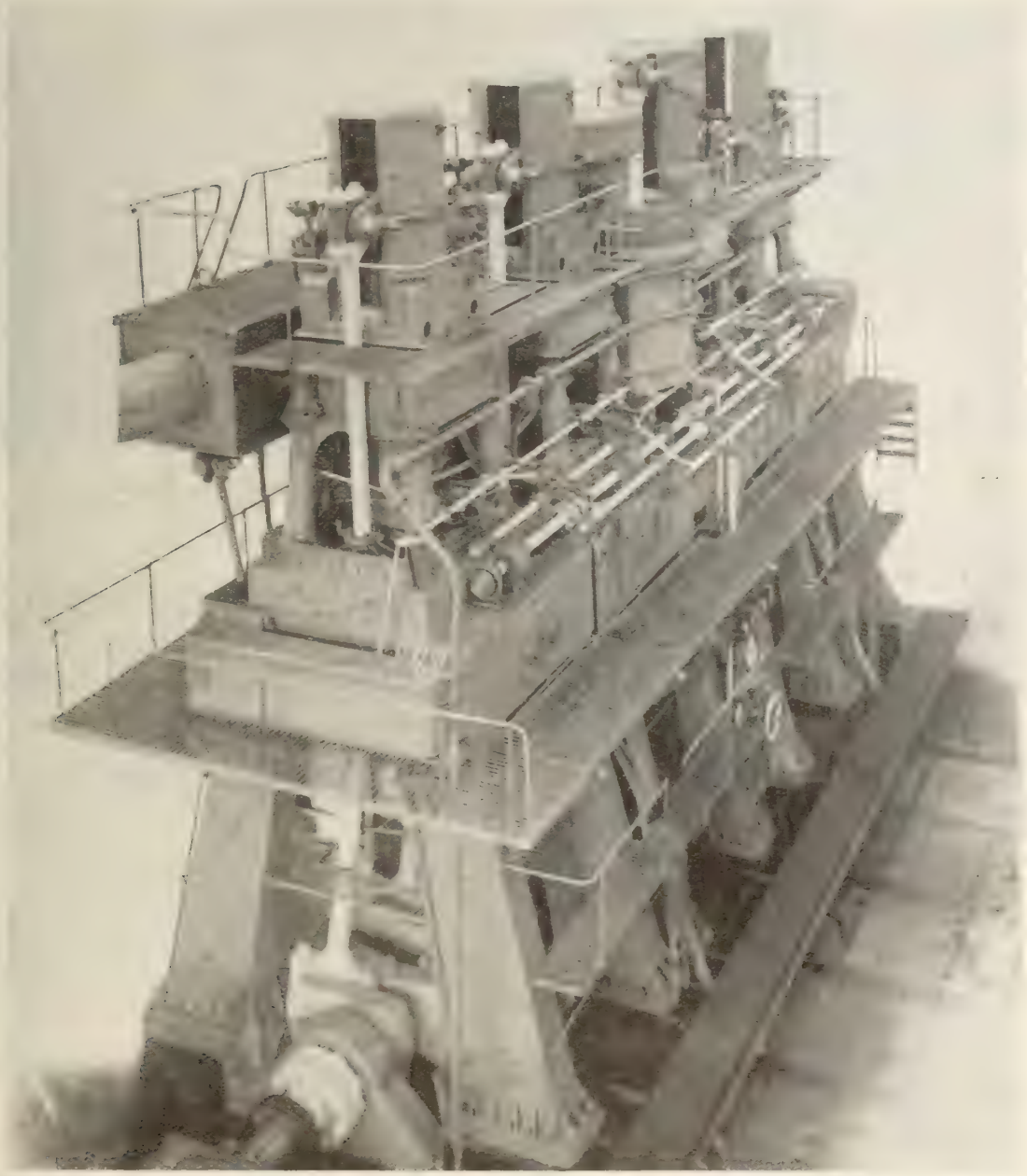

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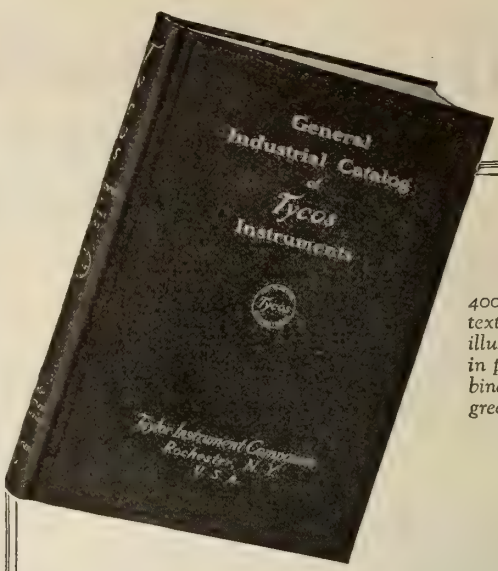

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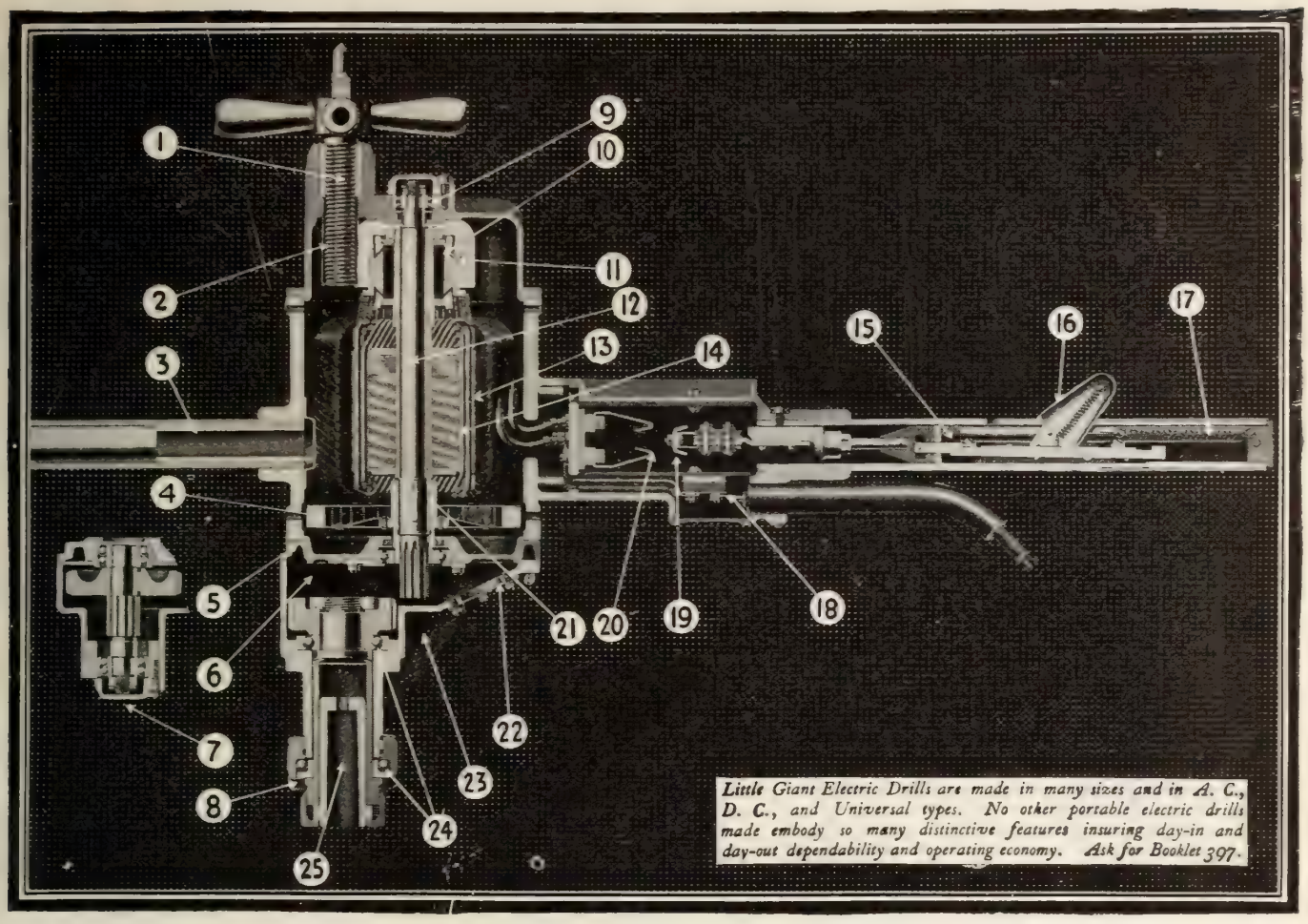

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why Little Giant Electric Drills accomplish results

1 **Long feed screw** entering into body of supporting bracket, thus giving same results as telescopic feed.
2 Protecting sheath, preventing entrance of dirt into drill if feed screw is removed.
3 Dead handle reinforced at point of greatest strain.
4 Sheet steel fan, carefully balanced and reinforced, providing thorough ventilation.
5 Solid transfer plate or diaphragm preventing grease or oil in gear case from entering windings.
6 Liberal grease compartment for providing reliable lubrication of gears and ball bearings.
7 Section thru intermediate gears. Note wide *double* row of ball bearings at each end of gear shaft (used on large drills). Pinion and gears made of special alloy steel carefully heat treated.
8 Dust protector for excluding dust from lower thrust ball bearing.
9 Ball bearing easily accessible for lubrication and inspection.
10 Commutator of sturdy design and construction, thoroughly insulated with mica.
11 Large opening with well secured and readily removable cover plates providing easy access to brushes and commutator.
12 One-piece armature shaft and pinion of tool steel, hardened and ground, insuring perfect alignment of pinion at all times. On large size drills armature shaft is removable from the armature core and commutator, which are mounted jointly on a quill or spider.
13 Laminated pole pieces, minimizing pole face losses (used on large drills).
14 Armature coils form wound, heavily insulated, and carried in insulated slots in armature core. After winding and connecting to commutator, coils and armature are again dipped in insulating varnish and baked.
15 Quick acting control switch, making slow break impossible and preventing destructive burning of contacts.
16 Conveniently located trigger for operating switch.
17 Safety return spring for automatically opening switch when operator removes hand from switch handle (used on large drills).
18 Terminal block for cable, permitting ready removal of cable without disturbing other connections.
19 Cover plates on each side of switch, providing easy access to switch contacts.
20 Double pole, double break switch. Rugged contacts are readily removable.
21 Long fan-hub of high grade steel, hardened and ground. Press fit on shaft with long key insures permanent rigidity.
22 Cover plate quickly removable for inserting grease in gear case.
23 Reinforcing rib on gear case, insuring proper strength and rigidity.
24 Combined annular and thrust bearing at each end of spindle.
25 Removable socket inserted in spindle. Driving lugs on socket milled from the solid.

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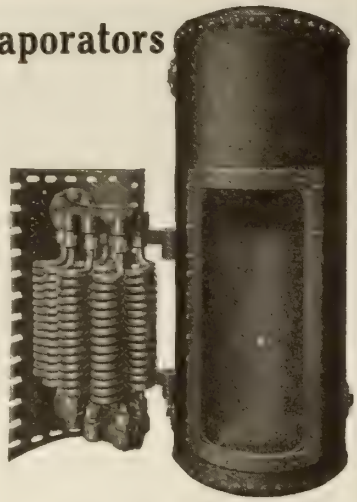

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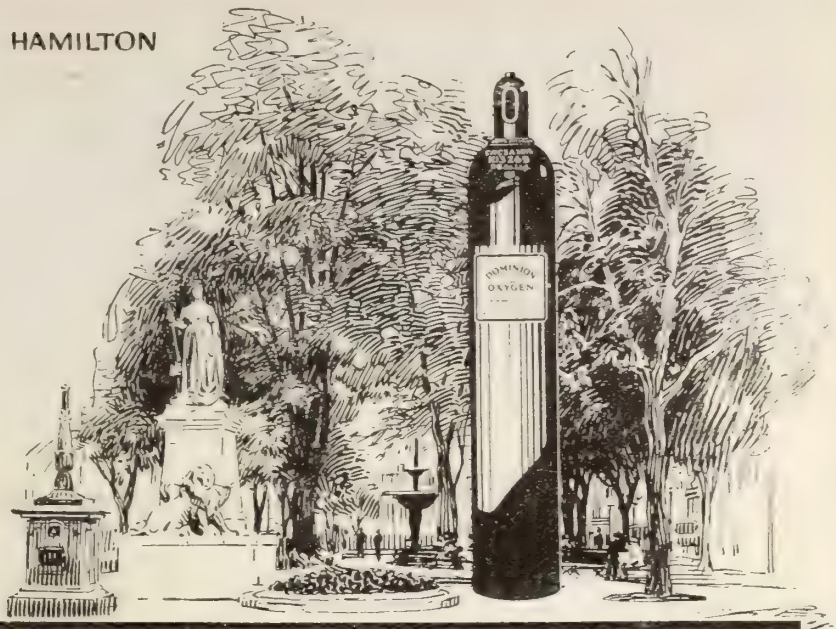

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The manufacture of uniformly pure oxygen in quantities large enough to insure prompt attention to your needs has been the aim of the Dominion Oxygen Company, Limited, since the formal announcement of its building plans. The fact that every order for oxygen is filled on the day it is received is evidence of the efficiency already reached.

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DOMINION OXYGEN COMPANY, LIMITED

Hillcrest Park, Toronto

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D-15

George Ham says "Good-Bye"

A STRIKING and affectionate farewell is bade by Col. George H. Ham in the March 15th issue of MACLEAN'S MAGAZINE, to his thousands of friends, as well as to other readers who may know him only by hearsay, who have been following his reminiscences in Canada's National Magazine since last August.

"The Curtain is Rolled Down, for seventy-three years makes a long act," says George. "Recalling three score and ten of these years has been a pleasant though difficult task; thirty-three of them have been spent in the service of the C.P.R., and one cannot but realize that the corridors of the Company's office will not long be trodden by the older ones of this generation and that some of us perhaps will soon not even be a memory."

"There Were Giants in Those Days"

The concluding instalment of this remarkable, all-Canadian feature, is the biggest and best of the lot—and here is the proof: There are seven full magazine pages, chock full of stories of those amazing days when the C.P.R. was conceived and constructed; human, hitherto unpublished details of the lives and careers of those three veteran founders, and, later, presidents of our first transcontinental: **Lord Mount Stephen,** the late **Sir William Van Horne,** and **Baron Shaughnessy, K.C.V.O.** And funny stories! Well, just read about Baron Shaughnessy's racing experiences; the pranks George Ham and William Stitt used to play on each other; Fred Cook's "German Band," and countless other incidents that could only be retained in such a mind—and heart—as that possessed by Canada's grand old raconteur.

Big Features of Fiction and Fact

"Personality, Plus"—By Guy Morton.
A fascinating story about an advertising agency man who put across a trick to close a contract—and then gave the whole game away.

"Lenix Fools the Jinx"—By Archie P. McKishnie.
Another of those deliciously droll Lenix Ballister negro stories, in which more than the usual number of comic and absurd scenes are depicted.

"Pawned"—By Frank L. Packard.
The third instalment of this masterful serial goes a long way to show how the triple regeneration is going to be effected.

"Broadway to Brussels"—By C. C. Jenkins.
The story of the rise of J. H. Gundy, a shy youngster, who developed into one of Canada's most brilliant orators and a leading financier.

"Little Bundles of Pluck"—By Agnes C. Laut.
In this, Miss Laut tells with graphic pen the story of some of the war brides who are making good out on the lonely prairies, where they and their husbands have been located by the S.S.B.

"A Woman Would Know ——"—By Charles G. Booth.
This whole gripping story centres around the possession of a wee bundle of humanity, cursed with a dope-fiend father. There is plenty of love interest, too.

"Those Who Stood in Darkness"—By J. L. Rutledge
A symposium giving the opinions of a number of Ministers of various denominations on some of the doubts which have arisen in this war aftermath, in the minds of many Christians—and others. An Easter Message.

Review of Reviews

"What Does Future Hold for Mankind?" H. G. Wells

"The World's New Leaders." Sir Philip Gibbs

"Labor Espionage in the U.S." Sydney Howard

"Bismarck's Account of Dismissal." Neue Zuricher Zeitung

"Ireland, the Enemy?" Harold Cox

"Devil Duval's Treasure." Chambers's Journal

"A Winged Torpedo Boat." "Tin-Fish"

"How Van Horne Rose." Walter Vaughan

"Criminal Tribes of India." London "Times"

"Salvaging Submarine Victims." Stuart Martin

"Greece's Great Renunciation." Pierre de Lacretelle

"Labor Must be Partner." George A. Greenwood

"Common-Sense Bridge." Manning Foster

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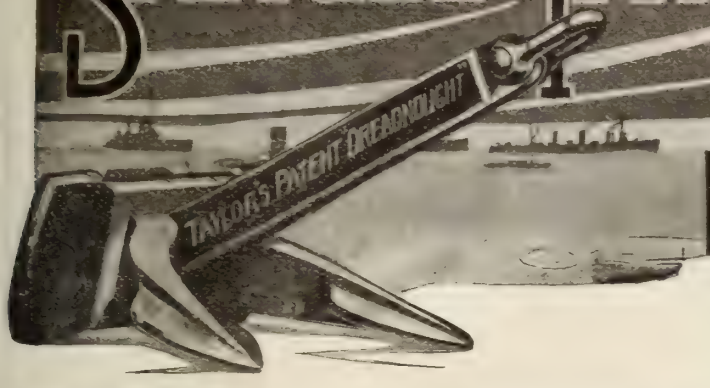

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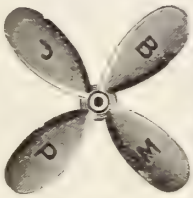

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All we need to have and to hold it is a sane, sure grasp on its simple elements.

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These are the cardinal virtues of human relations. They are the underpinnings of healthy, natural business life and the foundation of a wholesome social system.

They are the fountainhead from which Progress springs. A well-known business economist has called them the "Fundamentals of Prosperity."

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Buying is the backbone of prosperity. An active market means more employment, steadier earnings; benefits are passed around.

Wise spending gives stability to earning and for that reason is farsighted thrift and sound economy.

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To-morrow's change for the better will come about through the combined efforts of each and every one of us.

By sheer force of numbers and co-operation, by the high power of heart and mind, we can put Business on a firm, stable basis.

We can do this because all of the material factors making for better business are right.

Let us link our faith with industry, our vision with courage, and forge ahead.

Let's make an uncommon effort toward a common end—Good Times.

A message from the
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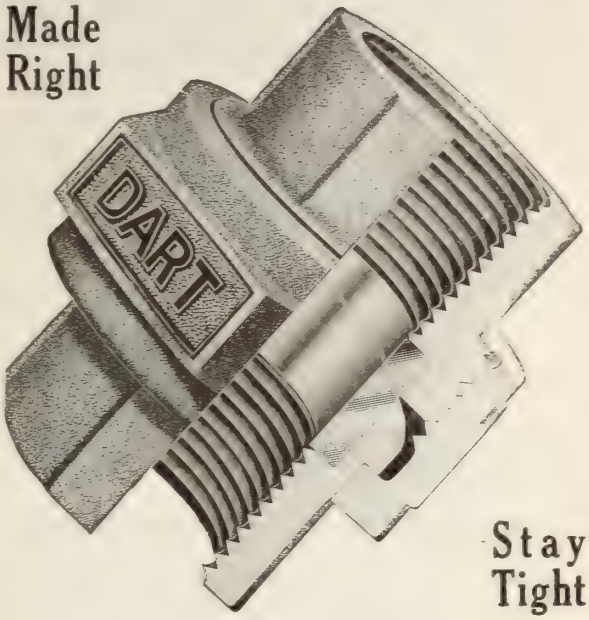

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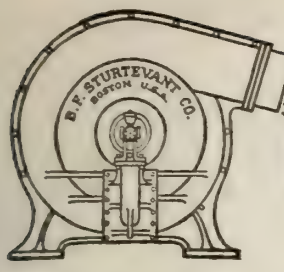

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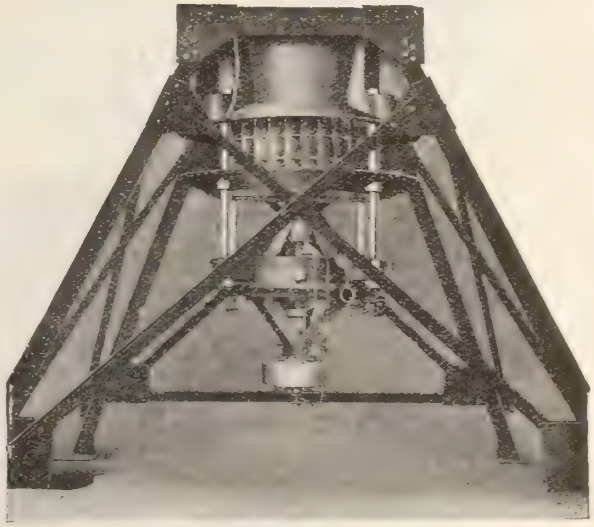

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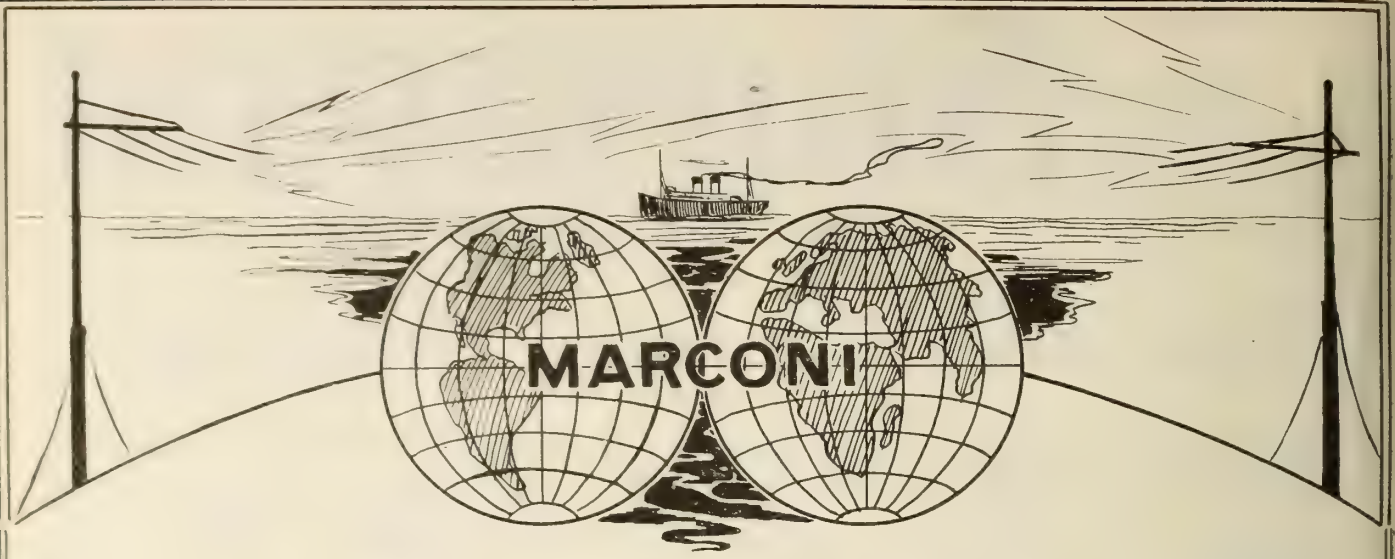

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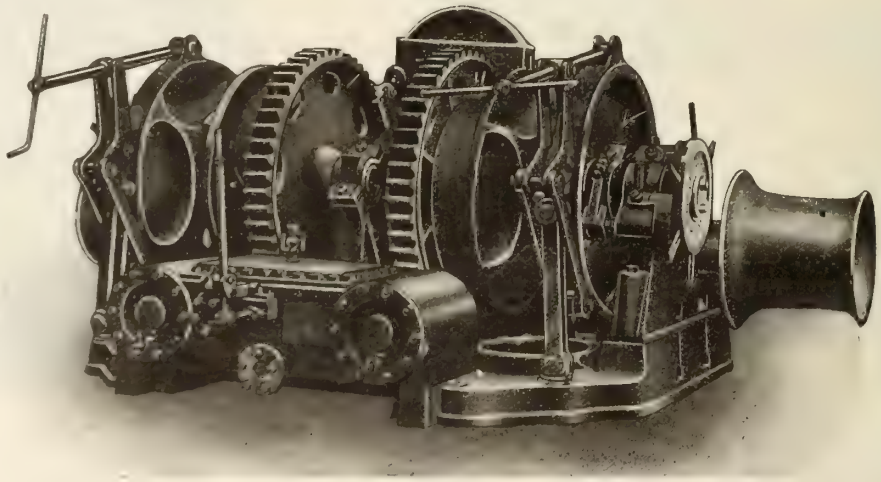

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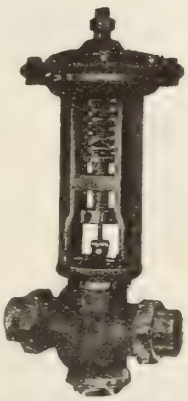

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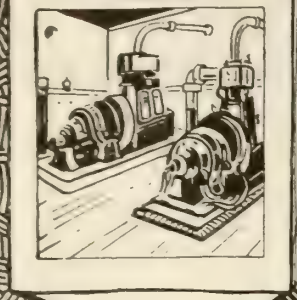

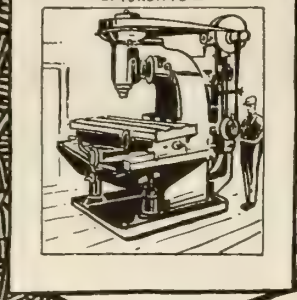

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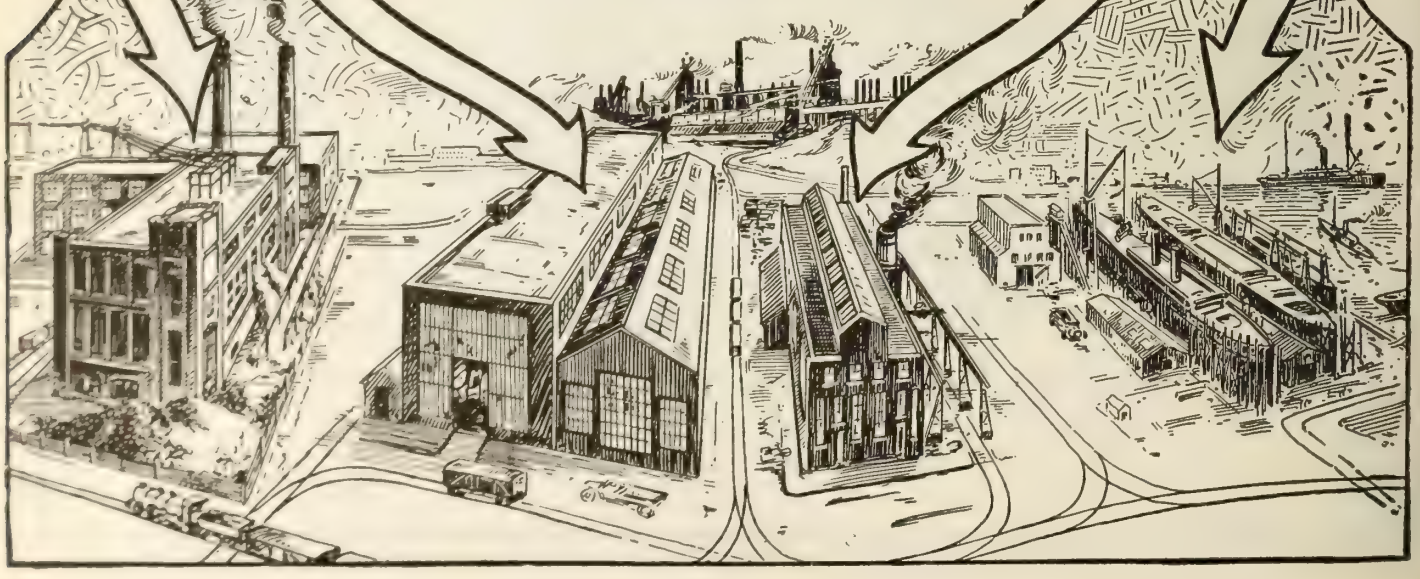

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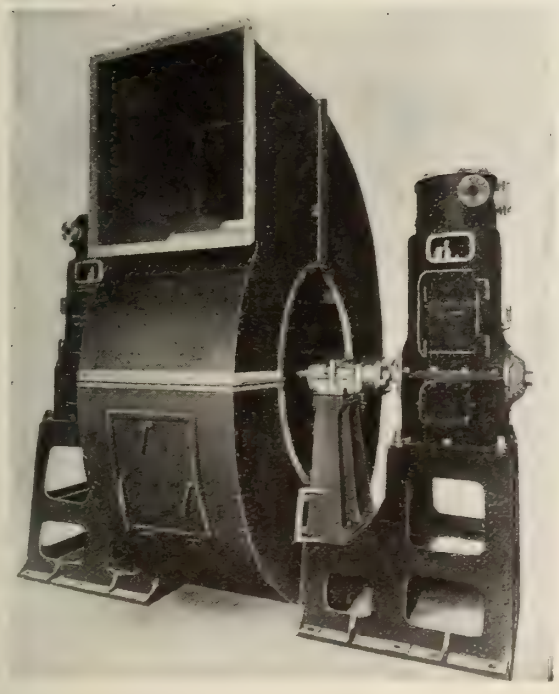

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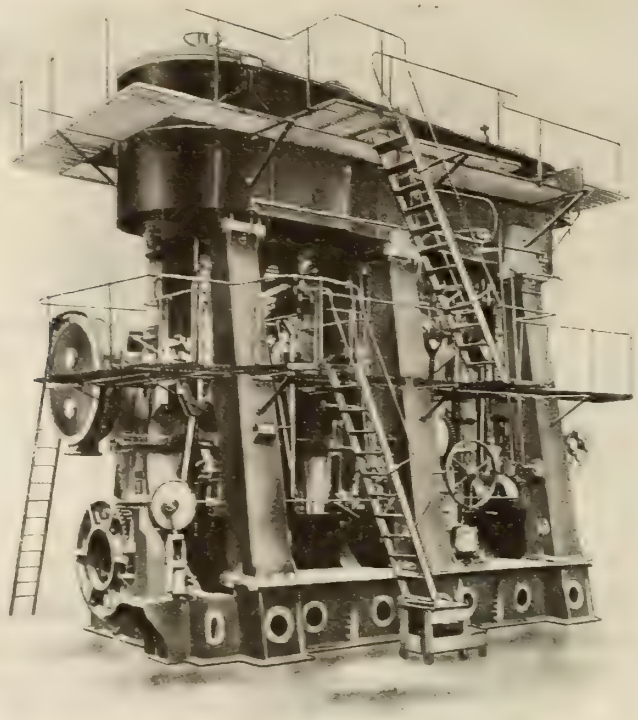

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Vol. XI. MARCH, 1921 No. 3

The Beardmore Semi-Diesel Oil Engine

A Full Description of This Four Cylinder Unit—Ignition is Effected by a Hot Bulb—Starting From Cold Ignition Is Procured by an Electrical Device—Method of Governing

OF the internal combustion engine there are several types, namely, gas, petrol and oil engines, and the two latter are developmnets of the former.

Inventors from the year 1678 to 1860 tried, unsuccessfully to produce an internal combustion engine which would be of commercial value, but it was not till the latter year that this was accomplished, when a four-stroke cycle engine became and remained the standard engine for eighteen years. In 1878, the Daimler engine came into prominence, and this used petrol as fuel in place of gas, but, as progress was made, heavier and cheaper oils were called for, as being more economical for commercial purposes, with heavier and higher powered engines.

This brings us down to the present day Diesel engine, which first appeared about 1895.

The semi-Diesel engine with which this article intends to deal, is a development therefrom, embracing some of the characteristics of the earlier oil engines.

It is now quite a number of years since William Beardmore & Company Limited, of Glasgow, with their ever present enterprising spirit, commenced the manufacture of semi-Diesel engines, of marine and land type, at their naval construction works at Dalmuir. The demand however for those engines having increased to such an extent, it was found necessary, a few years later, to acquire the Speedwell Works at Coatbridge to cope with the ever-increasing orders.

The semi-Diesel engine is quite distinct from the Diesel type, a fact which does not seem to be clearly understood. Engineers familiar with the Diesel engine realize the troubles of the cam shaft and the adjusting of the valves, spraying nozzles, air compression and scavenging. This is not likely to occur with the semi-Diesel type, as there is no cam shaft gear to worry them, also there are no valves, an arrangement of ports being used in their place, and the scavenging of burnt gases and air compression is effected by the piston itself, the whole engine being to all intents and purposes "fool proof" and does not require a highly trained man for operating.

The engine has been designed with a view to compactness, lightness in weight and perfect accessibility. Lately, the company has changed the position of the operating wheel to the after end of the engine, the same has also been done to the bilge pump, so that both the circulating pump and the bilge pump are now driven off the same eccentric at the after-end of the engine. The semi-Diesel engine is of the hot bulb type, but no blow lamp is required when "starting up," as a small electrical appliance is fitted to take its place; after starting the heat of the cylinder and piston is all that is necessary for ignition.

In the November issue of this magazine, an article appeared on the Sulzer and Still engines. The Beardmore engine is much simpler than either of these. The Sulzer engine has a separate arrangement for scavenging the burnt gases from the cylinder, whereas, in the Beardmore engine, this is effected by the under side of the piston taking the air in through valves on the crank case, if we may call it such. The Still engine is a combination of the steam and oil engines, and is of the opposed piston type, and is operated going astern with steam only, the steam being generated in a boiler heated partly by the gases of the exhaust and partly by an oil fuel equipment. This engine is at a disadvantage as compared with the Sulzer and Beardmore engines in having more working parts, and consequently more upkeep expense, and is fully 16 per cent. heavier. Although it gains a little by utilizing the heat of the exhaust gases, it is questionable if the gain is a saving at all. The 250 I.H.P. Sulzer and Still engines weigh 25 and 29 tons respectively, while the Beardmore equivalent weighs about 20 tons.

The following is a description of the Beardmore semi-Diesel engine:—

The Beardmore engine, as illustrated on full page plate, is at present designed for the requirements of lower powered vessels, i.e. vessels requiring anything up to 600 B.H.P. (or 1,200 B.H.P. twin screw), and is an ideal engine for yachts, coasting vessels, tugs and barges. It will consume fuels from 0.8 to 0.9 specific gravity. The engine shown is a 160 B.H.P. unit composed of four 40 B.H.P. cylinders, 11 inch diameter and 15 inch stroke, working on a two-stroke cycle, and running 280 r.p.m. This comparatively slow speed permits of high propeller efficiency. The engine is reversed directly by compressed air, no disconnecting clutch being necessary between the engine and the propeller.

Referring to section of cylinder Fig. 1. On the up stroke of the piston air is drawn into the crank chamber 1, through non-return valves, and is compressed on the down stroke and admitted to the cylinder through air ports, located directly opposite to the exhaust ports 2. These ports are covered and uncovered by the piston, which has a deflecting ridge on top, so as to give the air blast the direction most suitable for scavenging. While the under side of the piston is performing the functions of a scavenging air pump, the upper side compresses the contents of the previously scavenged cylinder on the upward stroke, in preparation for the downward or power stroke. Each cylinder has a separate fuel pump, and once in each revolution, fuel is sprayed directly into the combustion chamber 3 through atomizing nozzles fitted with automatic check valves, ignition being obtained through the fuel impinging on the heated surface of the combustion chamber. The combined heat of compression and combustion sustains the temperature necessary for ignition. An inspection of the indicator diagrams taken from crank chamber and cylinder figures 10 and 11 shows the sequence and co-relation of the operations within the engine. To obtain the necessary quantity of air at suitable pressure for scavenging, the crank

chamber space is reduced to a minimum, and made, as nearly as possible, air-tight, a condition hard to attain where the crank passes through the walls of the crank chamber, but the method adopted is interesting. In Fig. 1 a bronze ring 4 is bedded to the body of the shaft, close to the crank web, and is pressed against a machined surface on the inner side of the crank chamber by springs 5, between the ring and the crank web. The ring revolves with the shaft, and consequently wear is confined to the flat surface, and automatically corrected by the springs, which exert sufficient pressure to prevent the ring leaving its face when the air pressure in the crank chamber drops below that of the atmosphere. This arrangement is very necessary, as poor scavenging means loss of power and waste of fuel. Channels are provided between the main bearing cap and the side of the crank chamber, to allow the free escape of any small leakage past the ring, and so prevent interference of lubrication of the main bearing bush. Air is admitted to the crank chamber through grids at the front and rear, which are covered by flexible plate valves backed by light springs, and these are mounted on large doors 6, Fig. 3, the removal of which gives access to the crank pin bushes. For lubricating the internal working parts, a special positive forced sight feed system has been fitted, and is definitely controlled by the attendant. The oiling system is a feature worthy of note. Two eight feed lubricator boxes 7, Fig. 1 to 3, are employed, the drive being obtained from the fuel pump actuating gear.

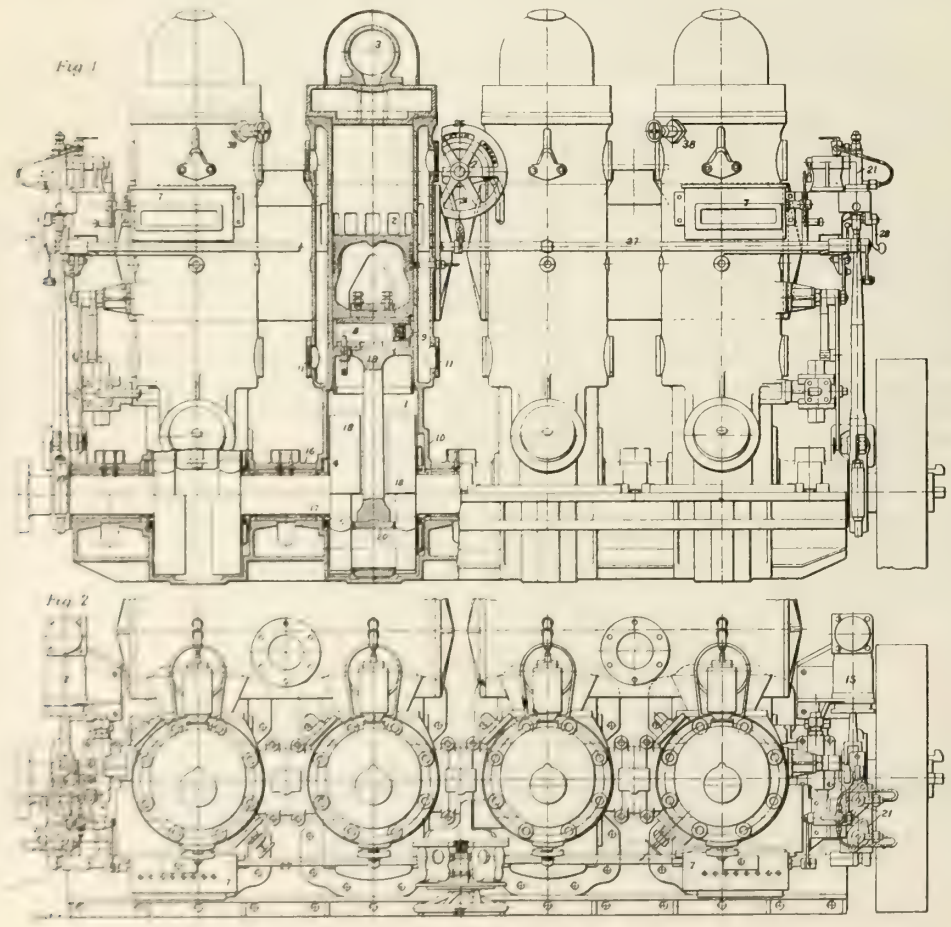
The cylinder and upper half of the crank chamber are cast in one piece, the cylinder being encircled by a water jacket having large cleaning doors 11, Fig. 1. The cylinder covers and silencers are also jacketed, and circulating water is supplied by a reciprocating pump 12, Figs 2 and 3, at the end of the bedplate, and actuated by an eccentric 13, Figs. 1 and 3, worked off the crank shaft. A bilge pump 15, Fig. 2, of the same size and design, is placed at the other end of the bedplate and similarly operated.

The bedplate forms the lower half of the crank chamber, and is cast in one piece. The main bearing bushes are made eccentric to the shaft on their outer diameter, so that they may be removed without disturbing any gear whatever. The crank shaft is a solid forging of Siemens-Martin steel machined all over, and large balance weights 18, Fig. 1, are secured to the crank webs, to give the engine an even turning moment, reduce vibration, and reduce the clearance volume of the crank chamber, thus increasing the scavenging efficiency.

The connecting rods are machined steel forgings, fitted with adjustable top and bottom end bearings; the latter are easily accessible through doors 6, Fig. 3, in crank chamber, and the former by removing the cylinder cover and drawing the piston and connecting rod upwards, the bottom having been disconnected.

The fuel pumps, 21, Fig 1 and 3, are grouped in pairs at opposite ends of the engine, and are operated by the eccentrics 13, Fig 1 and 3, previously mentioned in connection with the water pumps, a horizontal rocking lever, 22, Fig. 3, fulcrumed at its centre, being employed to carry the fuel pump strikers, 23, Fig. 3. The stroke of the strikers is, of course, very much in excess of that to be communicated to the fuel pump plungers, and consequently the discharge of fuel to the combustion chambers is restricted to a very short period. The idle portion of the stroke is utilized for governing purposes, and as the action of one is identical with the others, it will be sufficient to describe one. The pump striker is pivoted on the rocking lever, and is free to rotate, but for the action of a light spring, 24, Fig. 3, drawing it towards its guide. On the face of the guide a step is formed, which throws the striker off its original course, but as this effect is counteracted by the spring already mentioned, the engine speed determines whether the striker shall hit or miss the pump plunger. The tension of the spring can be adjusted to cut out at any engine speed, and when that adjustment has been made, the following conditions are fulfilled.

At all engine speeds up to and including a predetermined limit, the fuel pump delivers a definite quantity of fuel



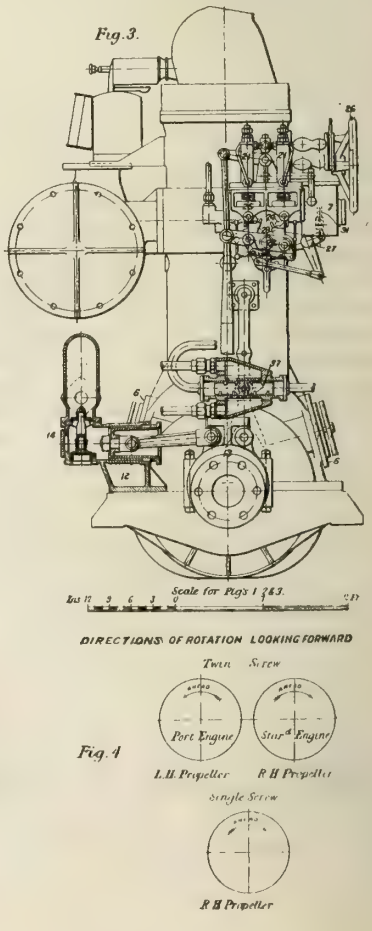


Fig. 4

THE "BEARDMORE" MARINE OIL ENGINE.

during a definite fraction of each engine stroke, the quantity delivered being entirely under the control of the attendant on the starting platform, and when the engine speed exceeds the predetermined limit, the pump automatically ceases to operate until the normal speed is regained. When it is remembered that all four fuel pumps are alike it will be readily understood that the system of governing is very sensitive and quick in action, and it is worthy of note that the tension of the governor springs can be adjusted, either individually or collectively, while the engine is running. The maximum quantity of fuel to be delivered at full power, is determined by a screwed collar, 25, Fig. 3, on the lower end of the pump plunger. By turning this collar right or left, the plunger is raised or lowered relatively to the striker, and consequently the stroke of the plunger is limited, but this adjustment, of course, is only required when tuning the engine to suit a given quantity of fuel, and should not be used for any other purpose. The ordinary control of the engine speed is effected through the hand wheel, 26, Fig. 1 to 3, placed at the centre of the engine. The fuel pump strikers are mounted on eccentrics in the rocking lever, and these eccentrics are connected by a system of levers and links to a horizontal shaft, 27, Fig. 1 to 3, running along the front of the engine. Any rotary movement of this shaft is therefore transmitted to the eccentrics, and strikers are thus raised or lowered collectively, according to the direction of movement imparted to the horizontal shaft by the hand wheel. Very fine graduations of the engine speed are obtained in this way. A priming handle, 28, Fig. 1, is fitted to each fuel pump for charging the pipes before starting, and any pump can be put out of action instantaneously, by raising the handle to a horizontal position. Should it become necessary for a pump to be put out of action permanently, the screwed collar already referred to, in connection with tuning, meets this requirement, and when thus cut out, the suction and delivery valves and springs can be removed for examination by simply disconnecting the delivery pipe and screwing out the plug in the top of the pump barrel.

Starting and reversing is performed by the aid of a single handwheel and compressed air from the reservoir, but need only be used for one revolution, simply to get the engine in motion. Though very simply done, the operation of starting and reversing requires an explanation which is out of all proportion to the operation, and the space available here to describe it. It is therefore omitted, save to say that it is an admirable feature of this gear, that no part of it is in motion except for a few seconds during each start and reverse of the engine, and therefore valves and other parts of it may be examined and overhauled, or one cylinder cut out altogether, while the engine is working.

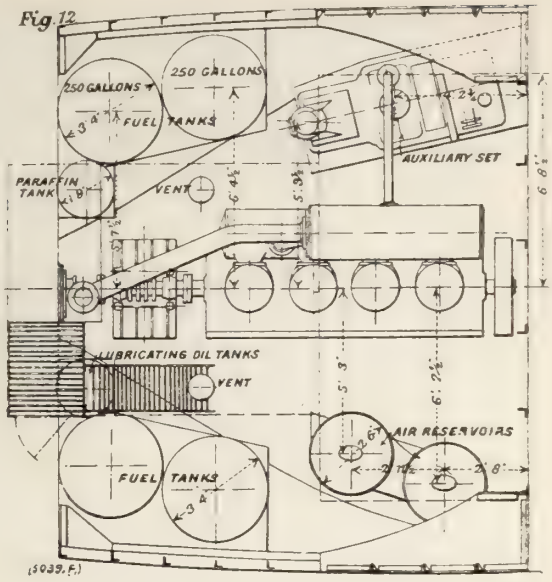


Fig. 12

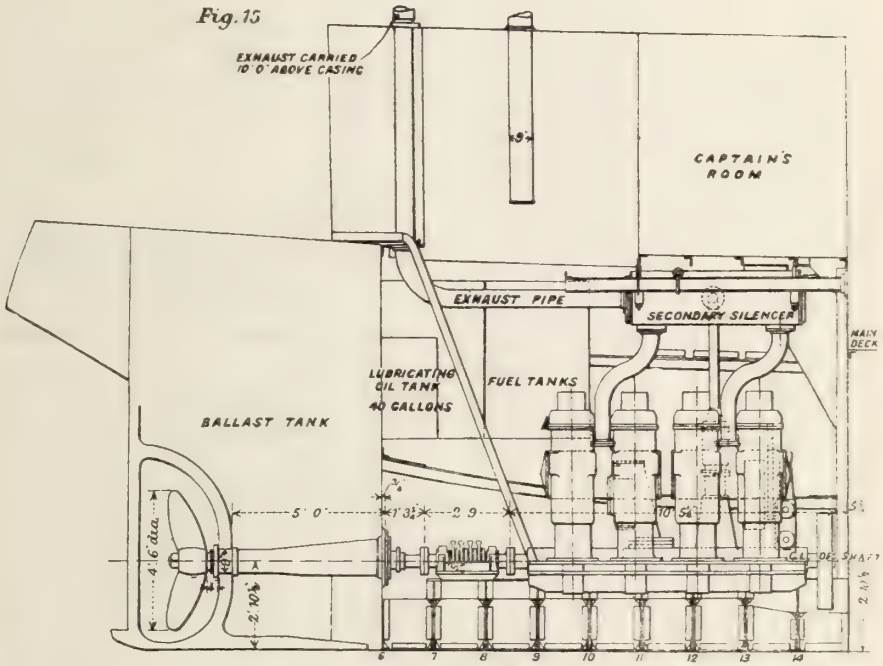
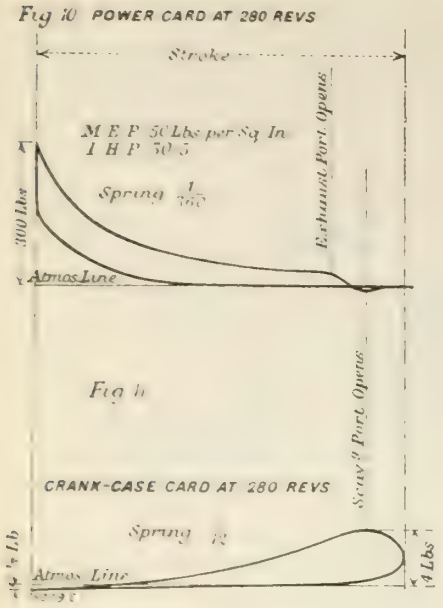


Fig. 13

PLAN AND ELEVATION OF ENGINE ROOM.

Two of the engine cylinders are fitted with spring-loaded non-return valves, 38, Fig. 1, through which the air reservoirs can be charged, while the engine is running. A sufficient supply can be maintained in this way for all ordinary purposes, but an independant power driven air compressor is supplied, to meet the requirements of excessive manœuvring, and to renew the supply should it be lost from any cause.

Figs. 12 to 15 show 160 brake horse power "Beardmore" engine installed in a typical British coaster, 75 ft. long between perpendiculars, 18 ft. beam, and 8 ft. 6 in. draught. The auxiliary set consists of an air compressor and general service water pump, driven by an independent oil engine, which operates on the same fuel as the main engine. The compressor is capable of charging the air reservoirs to a pressure of 350 lbs. per square inch, although the main engine can be started or reversed by air at 100 lb. pressure, and this allows air to be stored in excess of the quantity required for ordinary purposes. In fact, the air reservoirs are of such capacity that ordinary manœuvring can be fully met by one, while the other is kept charged for emergencies. The water pump is capable of performing all the duties of the main bilge and circulating pumps, and is also arranged to deal with water ballast. Fuel is stored by cylindrical tanks having a total capacity of 1,000 gallons, and this quantity gives the vessel an acting radius of 750 nautical miles. The propeller is of cast iron, and has three blades of large surface, the propeller shaft is of mild steel encased in a continuous gun metal liner, and the



POWER AND CRANK CASE CARDS.

stern tube is of cast iron fitted with renewable lignum-vitae bearings. The thrust block is of the most approved marine type, having individually adjustable shoes faced with white metal and a shaft bearing at each end. The engine in this ship is 10 ft. 5 in. long, from the forward face of the flywheel to the aft face of the crankshaft coupling, 5 ft. 4 in. high, from the centre of shaft to top of combustion chamber and weighs 145 cwt. with silencers, flywheel, mountings and piping. The weight of the complete installation, including fuel tanks, floor plates, pipes and connections, is 14 tons, and the engine-room bulkheads are 15 ft. apart.

This concludes the description, but, a few words on the type of engine will not be amiss. Oil is the subject of much talk at present, and the industry is still in its early stages, but things are developing fast, and the time cannot be far distant, when oil will displace steam, particularly as far as the smaller classes of vessels are concerned. The use of this type of engine for canal sized boats, barges and tugs has not yet received proper consideration, and owners and marine superintendents of companies will do well to investigate the Beardmore engine before placing their contracts for new tonnage, and consider it also for re-engining of old vessels. The engine is not an experiment by any means, and has already proved itself in all parts of the world. If owners would stop and think for a moment of the number of stations maintained by the Imperial Oil Company alone, around lakes, and consider the saving to be effected through time lost in bunkering at coal wharves, and all the consequent warping attached thereto, the cost of cleaning the ship afterwards, the demurrage of their vessels, the labour charges, and the fact that there is no necessity, with a semi-Diesel engine, of keeping up steam in a

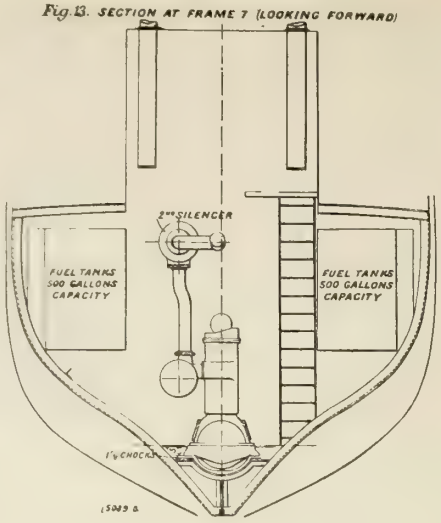
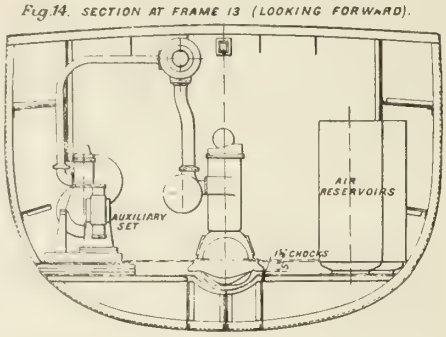


Fig 13. SECTION AT FRAME 7 (LOOKING FORWARD)
2nd SILENCER
FUEL TANKS 500 GALLONS CAPACITY
FUEL TANKS 500 GALLONS CAPACITY
1½ CHOCKS



CROSS SECTIONS AT FRAMES 7 AND 13.

boiler that is standing idle, particularly when a vessel is in port, then, it must surely dawn on them that they are spending a great deal of money quite needlessly. Oil has come to stay, for we are now entering an oil era, which will remain until science produces something even better. Among the advantages, in addition to the foregoing, that may be obtained by the use of the semi-Diesel engine are the saving of about 50 per cent. of the running costs, the higher average speed in a sea way, due to reasons which are obvious, the practical elimination of all fuelling appliances, smaller amount of accommodation necessary for engine-room staff, and the reduction of the engine-room staff itself. Perhaps the most important advantage, however, is the amount of cargo space gained, as the boiler-room does not exist, and so, it will be quite apparent, that for every ton saved in the machinery space, another ton of cargo can be carried.

The present-day engine is therefore the best possible, viewed from any angle, as to weight, durability, reliability, power, apearance, dimension or simplicity. Cost of maintainence is practically negligible. The fuel consumption is about .5 lbs. per B.H.P. per hour, and the present cost of fuel oil about 11 cents per gallon. The oil is forced into the cylinder without the use of compressed air, and it is questionable if any other engine is made having such a low compression. This engine does not require the services of a highly-trained man, as it is even simpler than the ordinary steam engine.

A NOTABLE FEAT OF SALVAGE

At the end of last November a serious mishap occurred at Wallsend, whereby a large French passenger liner, the s.s. Meduana, nearly 500 feet in length, after having been on fire in the fore hold, heeled right over on her starboard side. The raising of the ship was undertaken by Messrs. Lindsay, Swan, Hunter, Ltd., the well-known salvage contractors, whose headquarters are at Sunderland. They began their work on the Meduana shortly after the mishap occurred and have continued it for three months under the superintendence of Mr. Alfred Lindsay. The underwriters and the Salvage Association were represented by Messrs. Alex. B. Coull & Co., consulting engineers, of Newcastle-on-Tyne. A number of divers set to work to make sure that all the starboard sidelights were closed and then the ship's hatches, stairways, scuppers, discharge vents and other openings had to be closed. Holes were cut in the two upper decks to allow the water to drain into the lowest 'tween deck. Suction pipes were then introduced and the watertightness of each compartment was tested in a preliminary way. Towards the end of last month, after Messrs. Lindsay, Swan, Hunter had found that each compartment had been rendered watertight, the pumping was undertaken along the whole length of the ship. Twelve motor-driven pumps placed on barges alongside were working at the same moment, discharging water from the ship at the rate of fully 2,000 tons an hour. Most satisfactory progress was made and from the very first the ship steadily began to right herself until the starboard edge of the bridge deck was above water, leaving the ship heeled to starboard at about 50 degrees. The upper parts of the hatch-covers were then removed and Messrs. Swan, Hunter & Wigham Richardson's floating crane, "Titan," lifted some of the pumps and placed them in the holds of the Meduana. The water in the lower holds was extracted in this way and eventually the ship righted herself. The starboard ballast tanks had been filled to ensure the ship's stability and to prevent any danger of her rolling over to the port side. On the 10th March the Meduana was safely placed in one of the graving docks of Messrs. Swan, Hunter & Wigham Richardson, Ltd., Wallsend, for examination and repairs. By this successful handling of the Meduana, Messrs. Lindsay, Swan, Hunter, Ltd., have gained further renown, for they were already well-known for having achieved many notable salvage feats on the coasts of the United Kingdom, in the Mediterranean and in the West Indies.

The Future Power, Coal, Oil or Wind*

The Author, in a Well-reasoned Argument, Shows by Means of Price Curves Over One Hundred Years That the Purely Machine-Driven Vessel Cannot Be Profitable in an Era of Low Prices.

By C. O. LILJEGREN

THERE may be many sources of power hidden in this old world of ours, but so far only three have been discovered: fuel, water, and wind; and the greatest of these is wind.

The ultimate source of all power is, of course, the sun, which is sending us enormous supplies of energy every second. From his rays possibly another source of power may be found; perhaps electricity. For the propulsion of vessels, only fuel and wind can now be used. Manual power was first employed, and it will be the last to be used when every pound of fuel has been consumed and sails cannot be procured. It is still used for small vessels, and in the same manner sails, steam engines, oil motors, etc., will be employed when the next engine, probably the oil turbine, has been generally installed in ships and boats.

Fuel means fire, and as far as history dates back fire has been sacred. Some people even kept a constant fire burning—a big waste, and waste has been going on at an increasing rate to this very day. Our whole civilization rests on fuel, and every time one strikes a match he is working on the ultimate destruction of civilization. Fuel, therefore, must be saved.

As far as ships are concerned, wind only can be used to save fuel; if properly harnessed not only would an enormous amount of fuel be saved, but both passengers and freight could be carried in sailing ships at less cost per ton-year than in any machine-driven vessel, whatever the price of fuel. Although never stated in print, there is, of course, a limit to the price of fuel beyond which machinery cannot be run at a profit, whether at sea or on shore. Fortunately means are at hand, in Sauerbeck's index, to correctly estimate the limiting price.

Sauerbeck's index, Fig. 1, is the business barometer, and deserves to be carefully studied by every shipbuilder. Sir Alfred Yarrow recently gave a short exposition of the subject in his very able paper on "Our Economic Position," and I shall here only repeat that the index represents the mean price of 45 commodities, among which are fuels, the total average from 1867 to 1877 being taken as 100. Although begun about 1800, the index is homogeneous only after 1846; its yearly averages can be represented by a curve as shown.**

*Transactions of The Institute of Engineers and Shipbuilders in Scotland.

**Partly from Aschehoug, "National Economics," Christiania, 1910.

Three facts stand out clearly from this curve:—1, the steady succession of ups and downs of the price level; 2, the see-sawing of sail and steam; and 3, the war has put us back 100 years.

Our chief interest to-day lies in the see-sawing of sail and steam. Up to 1842 sail reigned supreme on the ocean, although steamships were invented in 1788—the reason being high fuel costs. From 1842 to 1853, steam tried valiantly to better its position, and ships like

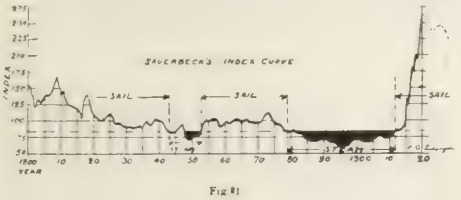


FIG. 1

the "Great Britain" were built. However, the high price period beginning in 1853 put a stop to this, and the "Great Eastern," the most advanced ship design of all ages, became the most unprofitable vessel ever built because built at a wrong time. On the other hand, the same high prices gave sail its chance, and the sailing ship did reach, in the clipper ship era, such a state of perfection as the world had never seen. It is hard to understand how the sailing ship, in the space of a few decades, could deteriorate into the common square-rigged vessel of yesterday, or the twin-screw under-powered auxiliary sailing schooner of to-day. There is an analogy here in the way the old Viking ships deteriorated into the mediaeval galley. Are we returning to a new dark age?

About 1879 the price level again sank and ushered in the present industrial period, during which steam had the ocean almost to itself, and sailing ships ceased to be profitable, mainly on account of indifferent design, and also from the low fuel costs. The only exceptions were a few German sailing ships, such as the windjammer "Potosi," which made splendid runs with great profits in the special trade of saltpetre transport.

Towards the end of this period (for ended it is), which has been called the coal age, oil became a powerful rival to coal as a fuel. In fact, were it not for oil fuel and the effects of the war, sailing ships would long ago have come into their own again. Singularly enough, the oil motor has given the sailing vessel a new lease of life, and profitable sailing ships are now unthinkable without motors. A hindrance and a help! Oil motors became a commercial success in vessels about 1912, the very time when the rising prices made steamers unprofitable again. The first hot-bulb motors were made in Sweden, and the first Diesel motors in Holland, and they were installed in vessels somewhere about the year mentioned.

A glance at Fig. 1 shows that sail changed to steam, and vice versa, when the index stood at 82.5. Here, then, is the limiting price of fuel, which so far seems remarkably constant, although economies in fuel consumption should have lowered the limit later. But fuel seems to have risen in price as the consumption per indicated horsepower grew less, and above all, the rise in the general price level made the running costs higher for the steamer. Fuel is used in the manufacture of every commodity, hence the sensitiveness of the index to high fuel prices, with which wages, too, rise and fall.

With the world war, prices took a sudden upward turn, and are now higher than at any time in our history, with the index at 265. The main question is: How long will this high price period last, and what will happen if the index should drop suddenly from 265 to 82.5?

The Riddle of Sauerbeck's Index. The first part of the question really points to the riddle of Sauerbeck's index. From Fig. 1 it will be seen that, besides the short undulations, there is a longer, more pronounced wave with a period of about 60 years. A clear crest can be seen from 1852 to 1879, a clear hollow from 1879 to 1911, and strong indications of another hollow are present before 1852, as well as a crest before 1822. Unfortunately, the index is, as mentioned, not homogeneous before 1846, although accurate as far as it goes.

But thanks to the thoroughness of the French, and the genius of a Swede, we have the means to solve the Sauerbeck riddle. The French wheat prices have been recorded since 1250, as shown by d'Avenel,* but the variations from year to year are so strong as to obscure the trend of the curve. By taking 20-year means, Dr. Axel F. Enstrom, member of the Swedish Board of Trade, got quite another picture, and his curves, published in the Teknisk Tidskrift, 1914, are shown in Figs. 2 and 3.

Fig. 2 depicts the French wheat prices, perhaps the most interesting economic

*G. d'Avenel, "Histoire Economique." Paris, 1898.

curve ever published. Food being the most important commodity, and wheat the most important food, it can be safely said that the general price level is depicted by this curve, at least up to 1800. Let us who were accustomed to buy our bread at about the same price year in and year out, before the war,

FIG. 2

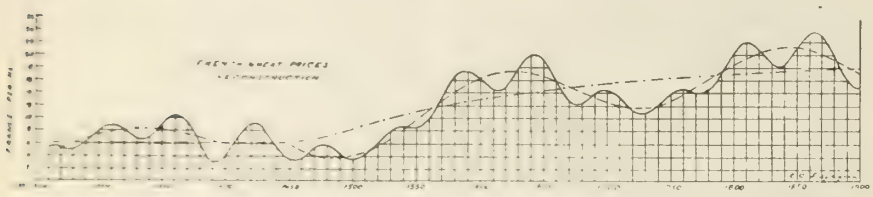


FIG. 3

consider how the prices have changed during these 650 years. See how cheap wheat was in 1465 and 1500, and how dear it was, eight times more, in 1590. What a crisis there must have been at that time, because the higher and thinner the crest the worse the crisis.

Fig. 3 is a reconstruction of Fig. 2, to make clear its component parts. The 60-year period in Sauerbeck's index has in Fig. 3 become the short undulations, with twin periods, not of 120, but 111.6 years (60 + 51.6), which, curiously enough, is the main period of the sun spots. The longer wave has a period of twice as much, or 223.2 years. In Fig. 4 is shown the actual and the estimated Sauerbeck curve, which I have extended to date and beyond.

The close agreement between the actual and the estimated index curves makes it safe to extend the latter as a guide to the economic future, as shown in Fig. 4. From Fig. 1 it will be seen that three consecutive high crests are followed by three consecutive low ones, that three high crests are now in order, and finally, that the present economic conditions are similar to, but worse than, those at the end of the Napoleonic wars. In 1809, the index stood at 170, whereas it now has reached 265, an increase of over 50 per cent.

It is thus perfectly safe to predict another high price period of about 30 years duration, during which sail once more will reign on the ocean, followed by a low price period of the same length. Then, if the waste of fuel goes on as hitherto, very few, if any, machine-driven vessels will be made to pay. But whether high or low periods, the three peaks always predominate, and every peak denotes a war or other crisis.

It would be very tempting to discuss the possible result of a drop in prices from 265 to 93, the estimated normal of 1920, but, instead of this, some special shipping curves may be considered and compared with the index curve. Unfortunately very little data have been collected regarding freight rates, but thanks to two British shipping firms, and to Norwegian statistics, it has been possible for me to construct a few freight-rate curves.

Fig. 5 shows the coal index (Wallsend) compared with Sauerbeck's, for which I am indebted to the editor of the Statist. Notice the effect of wars on the coal prices, the index curve of which nearly always lies above that of Sauerbeck. The only exceptions are just before 1870, and about 1880, at which time shipowners should have reaped a fine harvest. It must be borne in mind, however, that freight rates, coal, and other ship expenses generally rise and fall together —luckily for all concerned. In this, as

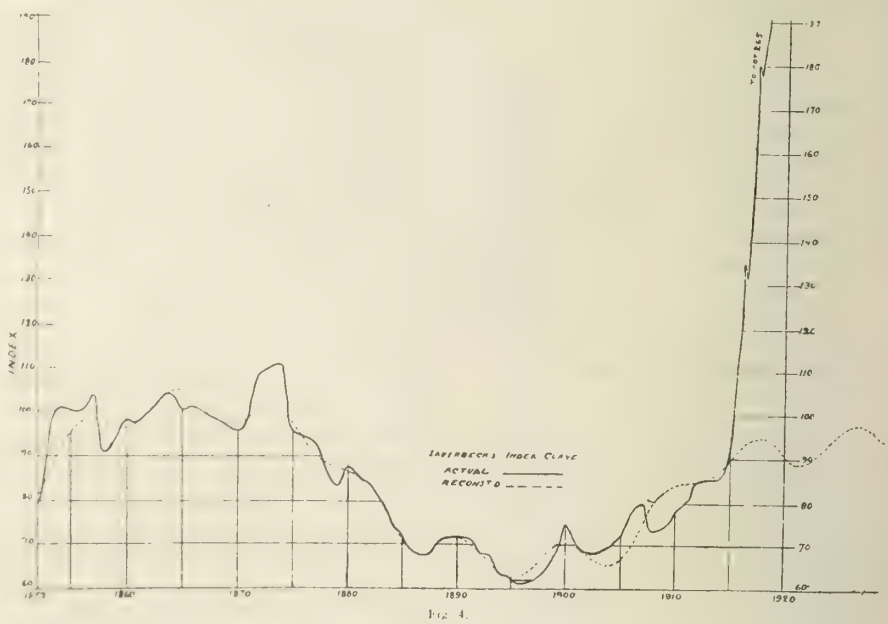


FIG. 4.

in everything else, the present time is an exception.

Fig. 6 is the curve of earnings per gross ton (from Fairplay) of the Oceanic Steam Navigation Co., and per ton deadweight of the Nitrate Producers' Co., kindly supplied to me by Sir John Latta. Both curves follow the index closely, and the former clearly bears out what has just been said about the year 1880. Compared with that year the present earnings are indeed moderate, notwithstanding the high freight rates.

These are individual firms, and the curves may not show the general trend so well. But the next curves, Fig. 7, are taken from official figures for the whole of Norway. The dotted line denotes the gross earnings of all Norwegian vessels; the upper full-drawn line is the gross freight earnings per net ton for steamers, and the lowest curve the gross freight earnings per ton of sailing vessels. Even here there is a close agreement with Sauerbeck's index curve; but a still more remarkable fact can be found from the average curves, namely, that the average freight rate of a steamer is about thrice that of a sailing vessel. Now a steamer carries about three times as much cargo in a given time as a sailing ship, hence, contrary to the general opinion, the average rates of both per ton of cargo carried are about equal.

Owing to the tremendous fuel consumption on land and sea, coupled with the attitude of labor, fuel must rise in price far above the index, certainly more than in 1872 and 1900. Simultaneously, for evident reasons, freight rates must drop, hence machine-driven vessels must cease to be profitable, first on long voyages, and later on short ones. Sail will prevail, and the time of the efficient sailing vessel will return, perhaps to stay.

It will be probably said this may be true when coal is used as fuel: But how about oil? Even when used under the boilers in a steamer, oil is more economical than coal. It is also more easily conveyed, and is cleaner, and when used in motor ships oil is the cheapest fuel yet produced.

Undeniably a motor ship shows a gain

in fuel economy over a steamer of equal power, but this is offset by the much higher first cost, depreciation, repairs, and interest of the former. A motor is a steam engine with its boiler furnace inside the cylinder of quick-running ma-

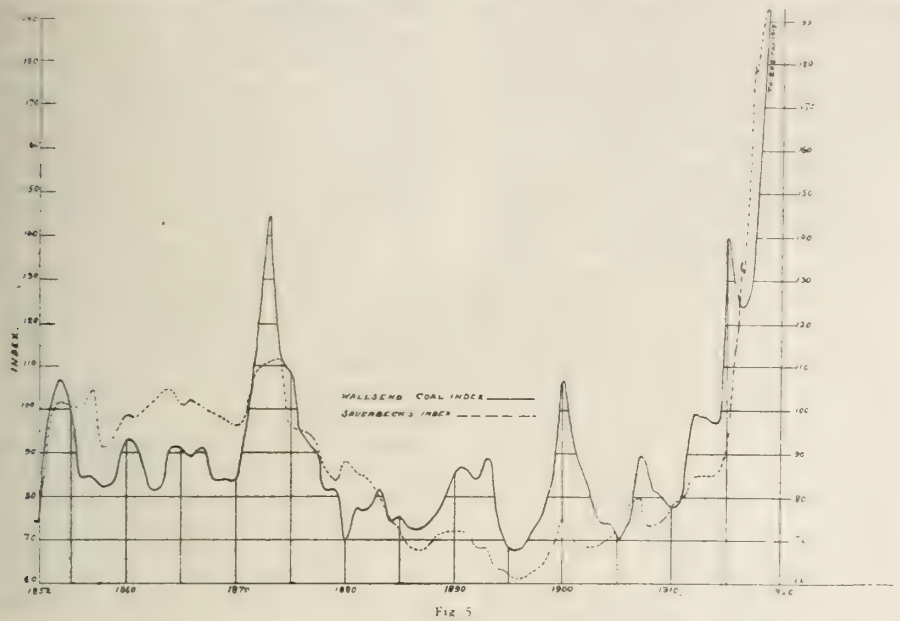


FIG. 5

chinery, and this cannot be conducive td small repair bills. True, suitable materials may be found: But at what cost? In all the leading technical papers, and in all the articles read before technical societies, one will seldom, if ever, find a reference to capital costs, although these are much higher than fuel expenses. Even in his recent paper read before this institution, Mr. Richardson does not lay stress enough on the matter of capital costs. Why? Generally only the fuel consumption of the main engines is given and compared with that of the steam engine, although the auxiliary machinery of a motor ship consumes far more fuel than that of a steamer, especially if a two-cycle motor is used.

In Appendices A and B have been tabulated the earning capacities of some actual cargo vessels in the same trade, the figures used being the average of several round trips during 1913-1914 and 1920 respectively. The costs, running times, fuel consumption, etc., are all actual, taken from Dr. William Scholz's book Schiffs-Dieselmotoren, and only the loading expenses, harbor dues, etc., have been carefully estimated. Such expenses are almost the same for all the vessels, and do not count much in the relative earning capacities, but are included for the sake of completeness, and to show the actual account of a cargo ship.

In Appendix A, with coal at 20s. and oil at 28s. per ton, the two-cycle motor ship only earned 26 per cent. net; the four-cycle motor ship 36 per cent., and the steamer with superheater 38.2 per cent. The mean freight rate was then 20s. per ton.

In Appendix B, with coal at 95s. and oil at 83s., both procured in the cheapest markets, the two-cycle motor ship is excluded, but with a mean freight rate of 55s. per ton, the four-cycle motor ship earned 28.5 per cent., against the steamer's 25.5 per cent. With oil burners installed, the steamer could have made 28 per cent., or about the same net profit as the motor ship.

Therefore, when all is accounted for, the motor ship is hardly more profitable than a steamer for round trips of less than 7,000 miles, even with fuel bought in the cheapest markets. But with growing consumption there will be no cheapest markets in a short time. Herein lies the fallacy of the motor ship. Oil cannot always be obtained in the cheapest markets anyway, and, if it could, there is so much less cargo carried corresponding to the weight of this fuel, with more expense and loss of freight money too. This is quite a problem in itself.

Some people will always argue that if this or that had not happened, etc., the result would have been different. Of course it would, but it is no use crying over spilt milk. If this war had not come over us, if the price level had not been raised, if the miners had not struck, if the United States had not built so many vessels, all would have been well for machine-driven vessels. Such occurrences are but links in a chain, or the weft and warp in the tapestry of the future.

There can thus be no doubt that all fuel will be too high in price for the profitable working of machine-driven vessels for at least 30 years to come. Besides, for the sake of industry and land transportation, fuel must be saved.

Now look at the other and more cheerful side of the picture. Trains and factories cannot be driven by wind power; but ships can, and some yachts extremely fast, for their size. Apart from this: Would it not be pleasant to own a merchant vessel that could be sent anywhere, independent of miners' strikes, fuel shortage, and other calamities of machine-driven vessels and with more profit for her owner?

Wind is the only thing that has not changed in price, and, unlike fuel, does not cost more to give more speed. If more speed is wanted in a steamer, not only must a more powerful engine be installed, but more coal must be carried and consumed, resulting in diminished cargo capacity. Not so with a sailing ship, where more speed does not generally mean higher cost or less cargo, if form and proportions be correct. Sailing ship design is now almost a lost art, or perhaps it has never been learned, if one considers the lessons of the yacht. True, there have been many fast sailing ships in the past, such as the "Cutty Sark" and "Lothair," both of which are still in existence, and the "Thermopylae," to say nothing of the many fine American vessels which actually drove British vessels from the sea. But these sailing ships, although fast, could not carry enough to pay dividends to-day, while they were helpless in calms and in strong head winds, which was perhaps their worst defect. Speed is essential, not maximum speed, but mean speed, and it cannot be secured without expedients to overcome calms and head winds, in

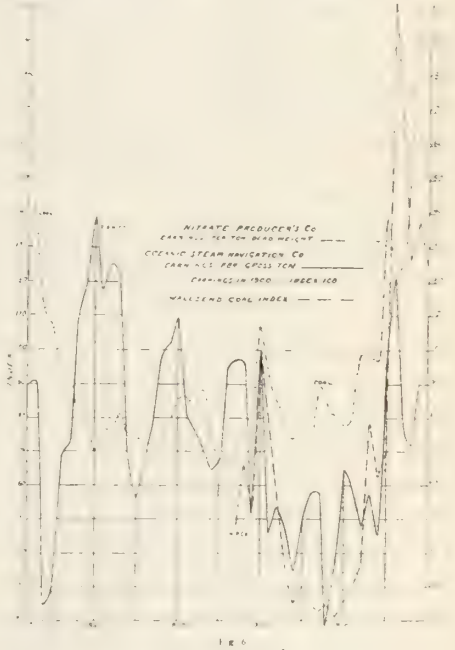


FIG. 6

which direction future improvements lie. Any box can sail down the wind; but the "windjammer" wins.

In thinking of a sailing ship, one generally pictures a big, lumbering thing that goes wallowing through the ocean at five or six knots, and that hardly can make 1.5 knots direct in the wind's eye. Such is the square-rigged ship with her

numberless blocks and ropes, necessitating a big crew. Even the gaff sail schooner is not much better off, but certainly she can lie closer to the wind, although she makes more leeway, and is admittedly slower down the wind. Both are very dangerous and unhandy in ballast, and ballast runs will be more frequent in the future than in the past.

Consider a modern sailing yacht, with her big, well-fitting sails, her simple rigging, her deep keel to stop leeway, and her artificial stability to get power and speed. What a contrast and what a lesson! Although she may not be very much faster down the wind than her sister of the sixties, her weatherly qualities will make her go round the course in a half or one-third of the time of the latter. Why, even the 70-footers that raced for the America Cup this year could cover a 30-mile course in less time than the old 90-footer "Reliance," which was the most extreme racing machine ever built, and thought to be forever the fastest. Theoretically, a 90-footer should be about 15 per cent. faster, and she is while running and reaching. The 70-footers made all their relative gain to windward. Here is the crux of the whole matter. If weatherly qualities are considered of paramount importance in pleasure boats: How much more are they necessary then in merchant ships? Why has not the sailing ship been improved like the yacht?

The success of a sailing ship depends on five conditions or qualities:

1. Big cargo capacity for a fixed tonnage.
2. Highest possible mean speed.
3. Smallest possible crew.
4. Independency of wind and weather, especially during calms and strong head winds.
5. Fuel price.

If sea-going qualities and strength are added, this should cover the whole subject of sailing ship design. These five points will now be dealt with.

1. There are certain proportions in the hull of a merchant ship that give minimum steel weights for a fixed tonnage, or, in other words, maximum available weights for machinery and cargo. These proportions can never be reached, because the classification numerals fix, for the minimum steel weight, L, B, and H equal. This is clearly a defect in the rules, and the well-proportioned hull should be favored, while extremes in either direction with bad sea-going qualities should be handicapped. With fixed L, there are certain proportions between B and H that give minimum steel weight, but these proportions can only be reached in a single-decked vessel. Curiously enough, these proportions give the best results for sea-going qualities as well as speed, in a steamer at least.

2. For speed down the wind, a steamer's proportions could be used for a sailing ship, but something more is wanted, namel, speed and weatherliness. Speed being largely a question of wetted surface, it seems strange that so little has been published concerning this matter. The only thing I have so far seen in print on this subject is Mr. Baker's paper on "Speed, Dimensions, etc., of Cargo Vessels," read before this institution on 18th February, 1919. His deductions are incorrect, as any ship draughtsman or engineer knows that a beam of almost four times the draught is not likely to give minimum wetted surface. The error lies in Mr. Baker using a ship with wedge-shaped ends, like that used in Kirk's analysis, instead of one with curved ends. Working on this problem 20 years ago, I found minimum wetted surface with a beam of twice the draught.

For sailing, stability is a sine qua non, but unfortunately natural stability can be had only by increasing the resistance of the vessel as well. In yachts artificial stability is secured by a deep lead keel, but, of course, in a merchant vessel every pound of weight must be reserved for cargo and passengers. I say passengers, because, within a short time, emigrants and other travellers, who cannot spend a fortune for an ocean ticket, will be carried in sailing vessels as in the old packet ships of the fifties. But, even when fully loaded, the natural stability of a sailing ship is not enough for maximum speed to windward, and some means must be introduced that works on the principle of shifting ballast. Water is clearly the only medium that can be used effectively, but the shifting must be automatic, and the cost of the appliance negligible. Even for this difficult problem I have found a solution.

Artificial stability thus being secured, some means must be found to stop leeway. The deep keel of a yacht is clearly out of the question, even if harbors were deep enough, and one has to choose between leeboards and centreboards. Leeboards were probably invented by the Dutch in the fifteenth century, and even double leeboards were used, two on each side.* In smaller craft they seem to answer well enough, but are impossible in a vessel of 5,000 tons. The centreboard is an English invention, and like so many others it has been developed by American shipbuilders and used extensively in the States. Its position in the middle of the vessel has a tendency to weaken her strength, and it could not be well applied as a single unit in a 5,000-ton vessel. Hence at least two centreboards must be used, one forward and one aft, giving a big gain in handiness and general safety under sail. Centreboards act as bilge keels, and effectively stop rolling, in addition they tend to keep the vessel straight on her course. Naturally, means must be provided to drop a centreboard in case of grounding.

With such simple means to stop leeway, it seems incredible that a single big sailing ship should be built without them. Fancy Sir Thomas Lipton trying to lift the cup with a yacht that had no deep keel. Why even his last "Shamrock" has a centreboard, and such vessels are only built for pleasure, as stated before.

3. Whether the eight-hour day will be introduced at sea or not, a big crew is a costly affair, and will effectively cut out the square-rigged ship in competition with schooners. The common schooner is, however, slower than a square-rigged vessel of the same size, and can only come into her own by using centreboards. Besides, to shorten the big gaff sails in a heavy wind is almost beyond human power, consequently the sails shorten themselves, into ribbons. But why not use double gaff sails, the equivalent of double foresails? By their use the effectiveness and small air resistance of the gaff sail is retained as well as the handiness of a double foresail, and all sails on one mast are served by a single sheet that can be taken home by an electric winch. If sails must be shortened, lower the upper peak and run in the foot, and the sail can be furled with ease to leeward of the lower sails. With double gaff sails the masts can be better stayed, and made considerably higher with less risk.

Still, a schooner may have too big a crew for her earning capacity, and then the only alternative is to use electric mast and rigging winches. Hand winches, or steam-driven winches, are very common on big sailing ships, but they are too slow and troublesome, because the halliards must be led along the deck. If wound on a separate barrel, the last heavy turns would cut into the loose layers under them, and the rope would surge constantly and badly. With the modern electric motor, it is comparatively easy to make a non-surging mast winch. In passing, let me say that delicate electric winches, cargo or otherwise, should be housed against the weather, at least by steel roofs or small houses with tonnage openings.

When mast winches are used in this way, not only can the crew be less in number but, above all, wire rope can be used for all the halliards, and for the sheets too, with a big saving in weight and cost. Whoever has tried to straighten the kinks in a wire sheet will understand the advantage of separate winches.

4. By the use of shifting ballast, double gaff sails, and centreboards, a sailing vessel may be made almost independent of wind and weather, except as regards calms, which are her worst enemy, and to overcome which some kind of propulsive machinery must be used, because, with high costs and wages nowadays, calms are too expensive. Unfortunately an engine costs a good deal of money too, but it is useful in many ways, especially in harbors, etc., and I do not believe a sailing ship would now be built without a motor.

To begin with, all steamers were

*"Fore and Aft," by Chatterton.

rigged as sailing ships, and were square rigged at that. With improvements in machinery sails grew less in importance, and were finally discarded. Sails were supposed to increase the speed with a fair wind, but they really retarded the ship much more in head winds. There was hardly any real gain to speak of, and the cost of the masts and top hamper was a big item.

Many shipowners have repeated this costly mistake during the last few years by putting masts and sails into vessels that really were motor-ships. Still another mistake, and a graver one, is to fit twin screws to sailing vessels, especially in square-rigged ships, where even single screws are of doubtful value. No motor in the world could drive a square-rigged ship against a strong head wind.

For many years I have repeatedly spoken against the use of twin screws in sailing ships, on account of the heavy drag by the shafts, bossings, and screws. It is impossible to understand how such a custom could have originated, except that the first motors were small and to some extent unreliable. Early steamship builders never used twin screws, and their vessels had often to rely on sails

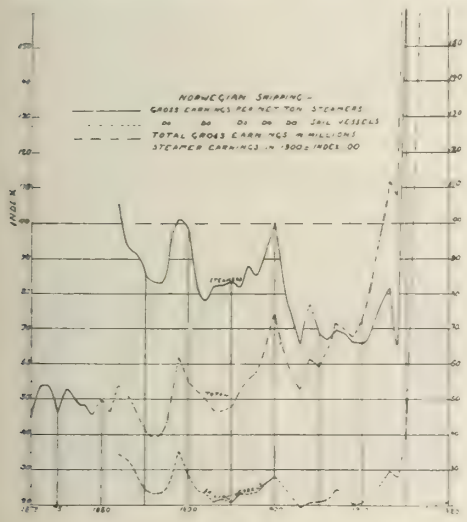

NORWEGIAN SHIPPING –
GROSS EARNINGS PER NET TON STEAMERS
TOTAL GROSS EARNINGS IN MILLIONS
STEAMER EARNINGS IN 1900 = INDEX 100
INDEX

FIG. 7

for propulsion. The famous yacht "Sunbeam" is a more recent example of a single-screw auxiliary vessel of exceptional merit.

If I am not mistaken, the "Sunbeam" had a two-bladed feathering screw, a type that does not cause any drag at all when placed in the middle of the ship's wake, with the blades vertical. The wake is made up of three parts: 1, water particles in turbulent forward motion from skin friction; 2, stream-line motion; and 3, bow-wave orbital motion; and when all three work in conjunction the efficiency of the propeller is increased. Some engineers try to belittle the gain from wake, but there is a decided gain in a single-screw vessel. In a sailing ship, of course, all of part 1 of the wake is lost, and parts 2 and 3, when working against each other, effectively put a stop to high speeds under sail. No sailing yacht, be she ever so fast, can be driven above the speed when the transverse waves balance at the bow and stern.

There is a widespread opinion that the drag of the screws can be lessened by making them revolve when sailing, but a more costly mistake has seldom been made. Even if the drag were lessened, which is not the case, the heavy wear and tear on the stern tubes, etc., should put a stop to the pernicious practice.

As a matter of fact, extensive German experiments in the summer of 1919, recorded in Hansa, show not the slightest difference in speed when sailing in a steady breeze at 6 knots, whether the screw was revolving or not. At the same time, in strong winds, and with all sails furled snugly, the speed was reduced from 7 knots down the wind to 3.5 knots dead against it, with the motor running alone. Except in a calm, the motor of 400 horse-power could never increase the speed under sail more than 2.0 knots, from 7.5 to 9.5 knots, under the most favorable conditions with all sails set except royals. Did the motor pay in the long run under such circumstances? Of course not. In these days of high costs, to put twin screws on a square-rigged ship is little short of a crime. When one sees twin-screw installations pictured in shipping journals, one begins to wonder if a period of retrogression has set in. Fully the area of one blade is hidden and made useless by the bossing, thus reducing the efficiency about 25 per cent. in a four-bladed screw. After finding out their mistake, one can almost hear the unfortunate owners with all their might denounce auxiliary sailing ships.

5. The higher the fuel cost the more profitable becomes the efficient sailing ship in relation to steamers and motorships without sails. With an auxiliary ship the principal question is the size and efficiency of the motor and the horse-power it should develop. With steamers and cheap fuel the matter of power was seldom considered at all. Enough power was installed to get 11 knots because someone else had done so. Nothing, of course, could be simpler. That most ships were overpowered, and that machinery was unnecessarily heavy and ocupied too much space, did not seem to concern shipowners at all, and shipbuilders very little. Even so recently as in his above-mentioned paper, Mr. Baker gave a formula, admirable as it is in some ways, that would prompt the shipowner to fill up his vessel with coal, in anticipation of the maximum profit, if the cost of coal were cheap enough. Where could cargo be carried in such a case? Nothing could better show the difficulty and importance of the problem, and many shipowners may think it wellnigh impossible of solution. It can be solved, and it is well worth the price and the trouble. In a sailing vessel the problem becomes still more intricate, for consideration must be given to efficiency of propellers, their drag, cost of power, lessened deadweight, to say nothing of lost capacity and so forth. The solution is shown in Fig. 8 for an auxiliary ship of about 3,700 tons deadweight, under the most up-to-date condtions, homeward with full cargo, and outward with only one-third of full cargo, or two voyages in ballast against one with full cargo. The freight rate in-

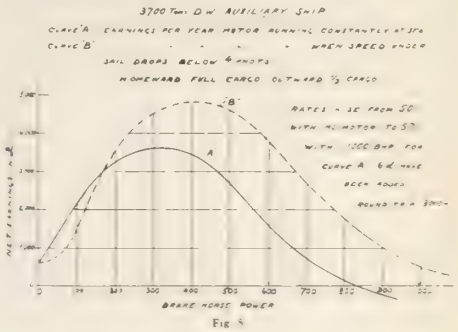

3700 Tons D.W. AUXILIARY SHIP
CURVE A EARNINGS PER YEAR MOTOR RUNNING CONSTANTLY AT 3½
CURVE B " " " " WHEN SPEED UNDER
SAIL DROPS BELOW 4 KNOTS
HOMEWARD FULL CARGO OUTWARD ⅓ CARGO
BRAKE HORSE POWER

FIG. 8

creases with the power, and two curves are shown, the dotted one depicting the net profit of the vessel when the motor is used only in light airs and calms, and the full drawn curve depicting the profit when the motor is running continuously during the voyage.

Everything has been made to ensure exactness in the estimate, and it will be noticed how quickly the profit falls off for a motor too big or too small. Notice, too, that the continuous use of the motor is not conducive to high profit, except at low speeds. There is a speed below which a ship is not allowed to pass through the big canals unassisted, or four knots in the Panama Canal. On the other hand, if 1,000 horse-power is installed in a square-rigged ship, she could not be operated at a profit, even with single screw, if the freight rate were below 57s. 6d. per ton for a round trip of 7,000 miles. But what steamer could make both ends meet under the same circumstances?

These curves are based on the sea speed of an actual sailing vessel on ocean routes, collected and analyzed by the German Hydrographical Office with the utmost care, so as to show the average length of calms, strong winds, etc., in each instance. I have tried in vain to find such information in Great Britain, where shipowners now seem to have put entire faith in steamers, just as their fathers put entire faith in the sailing ship of 1870, mostly with disastrous results. With the ever-changing price level, as exemplified in Sauerbeck's index, more types of merchant ships could be used with advantage.

The result shown by these curves, Fig. 8, agrees, for the auxiliary ship, very well with the results of other investigations regarding steamers, made by Mr. Anderson, Mr. Baker and Mr. Alfred Robertson of the United States. The slow speed ship is the money-earning

ship, about which there is no mistake. There is one thing I may be allowed to point out in this connection, that is that all investigators appear to have been running in a vicious circle. They assume the fullness or block coefficient in advance when the best value should, and can, be given by analysis.

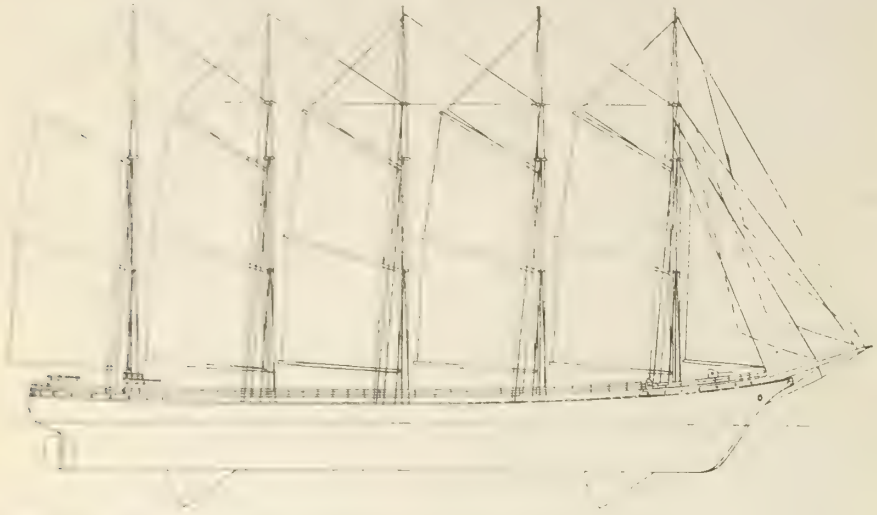


FIG 9--5000 TON MOTOR CLIPPER WITH DOUBLE GAFF SAILS TWIN CENTREBOARDS AND CRUISER STERN

If the single screw is accepted, and the most profitable motor size decided upon, there remains a most important detail to settle, namely, the form and dimensions of the propeller. Someone has said that nowadays hardly a merchant ship is built without reducing gear, and herein lies the kernel of the question. For with a suitable reduction one can use a light, easily-running motor and the most suitable screw for the thrust wanted. The problem presupposes that the most suitable motor and propeller have been found, but this may not be the case, and here lies a field for investigation in experimental tanks that has not even been scratched, but research work in this direction would be of immense value.

FIG. 10

Of course, the ideal propulsion for a sailing vessel would be hydraulic, where no screw at all is used, but there are too many drawbacks at present to this system in the weight of the contrivance, including water, and the many inherent losses in the system.

Thus far I have drawn attention to a few general misconceptions: 1, that machinery can pay with any price of fuel; 2, that the general price level is fairly constant; 3, that for a motor-ship fuel costs at present decide the profit; 4, that a sailing ship can be fast without leeboards; and 5, that revolving screws cause very little drag.

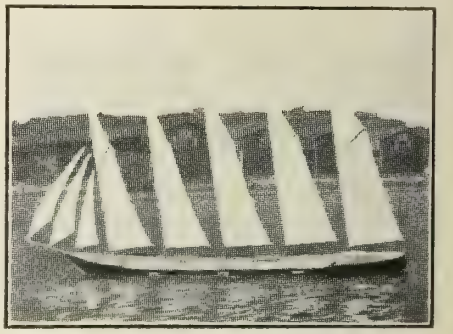
Going a short step further, it might be said that a sailing ship with enough speed can always compete with a machine-driven vessel. What is needed is not maximum speed in fair winds but average speed under all conditions. Anything can sail down the wind, and "a stern chase is a long chase" indeed. Some means have been found of increasing the average speed through: 1, correct dimensions of hull; 2, correct centreboards; 5, double gaff sails; and 6, motor and single screw.

The result of these investigations, incessantly carried on during 40 years, is shown in Figs. 9, 10, and 11. The vessel is called the "motor-clipper." Fig. 9 gives an idea of her sail plan, Fig. 10 of her midship section compared with an ordinary sailing ship, and Fig. 11 is an illustration of an 8-foot model when sailing. The model, by the way, filled with cargo so as to preserve the centre of gravity, proved uncapsizeable when tested in a manner that no full-sized ship could stand. Perhaps the most remarkable feature about the motor-clipper is her full midship section, but it can easily be shown that a rectangular body, or anything approaching it, contains less wetter surface and less hull surface per cubic foot of displacement than any other other geometrical form of section. This is the reason why merchant vessels now are given almost rectangular midship section, whereas most ships from the earliest dug-outs were round-bottomed. The "Great Eastern" is a notable example, and perhaps her round bilge had much to do with her failure financially. In her case there was too much steel to draught.

Another feature of the motor-clipper is her cruiser stern, perhaps the first sailing vessel so fitted. The ordinary stern is, of course, nothing more than the cruiser stern lifted high out of water, where it does no earthly good at all, and is simply a survival of the old "castelles" that were necessary for the defence of early fighting ships. As a yacht designer, with much of my schooling from the Herreshoffs, I have always wondered why the cruiser stern was not universal, for both theory and practice have shown its superiority to the ordinary stern. It may be that the cruiser stern does not take so kindly to the eye accustomed to the ordinary stern, but nowadays a ship must be built for service, not for looks.

The motor-clipper can use her sails to the best advantage. A good captain can almost make her "eat out of his hand," and with her two centreboards handle her like a living thing. He will know that she will go where he points her, not somewhere else within two or three points, and she is uncapsizable.

She denotes a radical departure from the ordinary run of sailing ships, and this must obtain if a commercially successful vessel is required. A new type of vessel has sprung up, almost overnight, in the auxiliary sailing ship, but like every other type of vessel she must



THE MOTOR CLIPPER

experience the process of evolution. But this evolution can be hastened by a proper application of our present knowledge of sailing ship design as exemplified in yachts, not by a conservative adherence to old forms and customs. In the face of the evidence presented here, who can doubt that the motor-clipper will reach the same high state of perfection, in the coming high-price period, as the old sailing clipper did in the last high-price period from 1853 to 1878? Radical as she is, still the different features of the motor-clipper have been tested separately in practice, and only the grouping together is new. Who ever heard of a sailing ship with cruiser stern, twin centreboards, and double gaff sails? Yet these features are, together with artificial stability, most of all needed for a profitable sailing ship today.

The old sailing ships were helpless in calms, and almost so in head winds;

they were delayed unreasonably in harbors, could carry very little deadweight on their registered tonnage, and were forced to carry a big crew. Considering all this, and the means by which the defects can be overcome: Can there be any doubt that the motor-clipper can carry three times as much cargo as a common sailing ship in a given time, and at higher rates too? The most successful machine-driven ship cannot do more, and think of the fuel that would be saved!

In 1840, the United States took the lead through her excellent sailing ship designs, and rapidly drove every other nation from the ocean. In 1870, Great Britain profited immensely by her quick grasping of the coming change to steamers, although steamships were, until then, mostly developed in the States, the "Savannah," for example, being the first to cross the Atlantic; and although countries thus gained and lost, shipowners and shipbuilders were the real gainers and losers. Mr. Baker stated recently that "between 1841 and 1847 no less than 40 shipbuilding firms in Sunderland went bankrupt." He did not state the number of their unlucky brethren on the Clyde, nor how many shipowners were forced to the wall. The same thing happened 30 years later in the United States, where, at my first visit in 1895, steel shipbuilding was almost a lost art.

History repeats itself, although its tools change. There are reasons to believe that the new epoch will be much more disastrous to the laggard than former epochs, because of the terrible effects of the war and the consequent high-price level, higher than ever in the history of the world. But in dealing with future problems they must be approached with open eyes and time taken over their consideration.

Whatever the future has in store, ships must be built. "Navigare necesse est, vivere non." But the most profitable ship will survive, with her owner and builder.

APPENDIX A.

Earning Capacity of Cargo Vessels, 1913-14.

	Motor-ship, two-cycle.	Motor-ship, four-cycle.	Steamship, superheat.	Motor-clipper Auxiliary Sailing-Vessel
Deadweight, tons	7,515	7,340	8,010	7,150
Cargo weight, tons	7,045	6,965	7,090	7,000
Crew complement	41	35	44	27
First cost	£124,000	£103,150	£94,500	£68,000
Yearly expenses—				
Insurance, depreciation, and interest, 18 per cent	22,325	18,575	17,025	12,250
Wages	3,087	2,725	2,860	2,085
Food, 1/9 per day	1,310	1,118	1,405	862
Fuel at sea, in the roads, and in port	3,719	2,834	7,352	1,043
Lubricating oil	732	286	82	225
Stevedoring	8,450	8,350	8,500	8,350
Ship's expenses	2,405	2,405	2,405	2,405
Tonnage dues	2,587	2,550	2,250	2,793
Commissions	3,165	3,133	3,188	3,150
Repairs, 2.5 per cent.	3,100	2,583	2,363	1,700
Office expenses	1,170	1,102	900	850
Tug-boat hire, etc.	160	160	160	225
Miscellaneous	250	250	250	250
Total expenses per annum	£52,461	£46,071	£48,739	£36,199
Freight income at 20/-	£84,611	£83,500	£85,100	£84,000
Net earnings	£32,150	£37,429	£36,361	£47,811
Per cent. of investment	26.0	36.2	38.5	70.2
Do. if freight rate is assumed to be 15/-	3.3	9.9	9.5	31.5

The first three accounts are for actual vessels for a round trip of about 7,700 miles, six trips per year each way.

The account for the motor-clipper is carefully estimated from existing auxiliary sailing vessels of ordinary type.

Fuel prices f.o.b. bunkers: coal 20/-; oil, 28/6.

APPENDIX B.

Earning Capacity of Cargo Vessels, 1920.

	Motor-ship, four-cycle.	Steamship, superheat.	Motor-clipper, 7,150 tons.	Motor-clipper, 11,600 tons.
Deadweight, tons	7,340	8,010	7,150	11,600
Cargo weight, tons	6,965	7,090	7,000	11,200
Crew complement	39	48	32	35
First cost	£367,000	£336,420	£243,100	£367,000
Yearly expenses:—				
Insurance, repairs, and depreciation	66,000	60,500	43,700	66,000
Wages	10,700	13,200	8,800	9,620
Food	2,920	3,580	2,360	2,580
Fuel at sea, in the roads, and in port	8,250	32,400	2,110	2,600
Lubricating oil	930	380	250	330
Stevedoring	16,700	17,000	16,800	23,450
Harbor dues, commissions, etc...	16,700	17,000	16,000	23,450
Office expenses	2,000	2,000	2,000	3,000
Miscellaneous	1,500	1,500	1,500	1,500
Total expenses per annum	£125,700	£147,560	£ 94,310	£132,530
Freight income at 55/-	£230,000	£234,000	£231,000	£363,000
Net earnings	£104,300	£ 86,440	£136,690	£230,470
Per cent. of investment	28.5	25.5	56.0	63.0
Do. if freight rate is assumed to be 40/- per ton	11.3	6.7	30.3	36.0

The first three accounts relate to the same vessels as in the foregoing table, but the two-cycle motor-ship has not been included. Instead of this, there has been added an account for a motor-clipper of the **same cost** as the four-cycle motor-ship, **i.e.**, the same invested capital.

Fuel is regarded as bought in the cheapest market: coal at 95/-, oil at 83/-. If based on current fuel costs, the earnings of the motor-clippers would be much higher, and those of the other two vessels much lower.

If oil burners are installed in the steamer, there will be a gain (**vide** accounts of the Morgan liner "El Norte") £13,800 in fuel costs, and £2,200 in wages, whilst £3,300 are lost in freight money, because fuel for the round trip must be bought abroad. The net gain amounts to £12,700, increasing the profit on investment to 28 per cent., or about the same as that of the motor-ship.

Tankers. As a tanker, the motor-clipper can deliver about 6 per cent. more cargo per annum, and burns about 4 per cent. of her cargo less oil, or 10 per cent. more oil delivered in total, at far less cost than the motor-ship of the same deadweight.

WAGE SCALE OF LAKE ENGINEERS

The wage scale for the engineers on the Great Lakes as agreed to by the executive of the National Association of Marine Engineers is as follows:

For passenger ships of 3,000 tons or over, the chief engineer is to receive $2,400 a season. The second engineer to be paid at the rate of $180 per month.

For passenger steamers of 1,250 tons and under 3,000 tons, chief engineers will receive $2,100 per season and second engineers at the rate of $150 per month.

For lake passenger steamers under 1,250 tons and all passenger steamers confined to river service, where a second engineer is required, the rate of pay for the chief engineer is $1,650 a season and $140 per month for second engineers.

On all passenger steamers of 45 n.h.p. to 25 n.h.p. the chief engineer will be paid at the rate of $150 a month and the second engineer at $110 per month.

On all passenger steamers under 25 n.h.p. the chief engineer is to receive $125 per month.

Freight steamships are also included in the scale. On freight steamers of 5,000 tons or over the chief engineer will be paid $2,400 a season and the second engineer $180 per month. On steamers of 3,000 and under 5,000 tons the chief engineer will be paid $2,200 a season and the second engineer $160 per month.

On freight steamships under 3,000 tons requiring a second engineer, the chief engineer is to be paid $2,000 for the season and the second engineer $150 per month.

On freight steamships not otherwise classified the wages for chief engineer are set at $165 per month and the second engineer at $130 per month.

Tugs are also included and the wages run from $150 to $185 per month for chief engineers and $120 to $145 for second engineers.

Kingston.—Navigation was opened in Kingston on St. Patrick's day by the steamer "Wolfe Islander," which made her first trip to Wolfe Island on that date. Last year navigation was started on April 6th.

One or Two Boilers? What's the Answer?

The Argument For One Boiler Seems Reasonable Enough Until One Gets a Practical Lesson on the Subject—An Unpleasant Experience in the Bay of Biscay in a Converted Compound

By T. H. FENNER

A FEW years ago there were quite a few ships changed over from compound low pressure jobs, to compounds carrying a high pressure usually about 180 lbs. per square inch. The practice in some of these cases was to replace the two original boilers with one large sized boiler, and at the time many engineers questioned the wisdom of installing only one boiler in an ocean going ship.

The reason for changing these ships over was of course to procure greater economy of running, without the expense of installing a triple expansion engine. The low-pressure cylinder was fitted with a small liner to give a better balance with the higher pressure on the high pressure cylinder, and the high would carry about 180 lbs. initial pressure, and exhaust at about 20 to 25 lbs. to the low pressure cylinder. This of course gave a much greater temperature range than obtained with the original arrangement, in which the high pressure would require about 80 lbs. and low about 10 to 15 lbs. One high pressure boiler with relatively less heating surface could be installed with forced draught, and the whole arrangement made a much better job from the owner's point of view. However, as stated before, all engineers did not agree with the one boiler installation. I had worked on several of these jobs while serving my apprenticeship, with little thought that I would ever have the pleasure (or otherwise) of sailing in one of them. However fate decreed that I should later become second engineer of one of these hybrids, sailing from Liverpool to Mediterranean ports. The job was by no means a bed of roses, but the Mediterranean run has compensations of its own, and whatever our sea experiences were like, we usually had a pretty good time in the sunny seaports we visited. We were fortunate in that we had fairly long loading and discharging time, so had a chance to observe the beauties of nature which these ports offer for the eye of the wearied sailor. We used to run from Liverpool to Genoa, usually taking about nine days for the run, thence to Leghorn, Naples, Messina, Palermo, Syracuse, Marsala, Palermo, and calling at Bastia, in the Corsican group, wend our way home via Valencia and Denia in Spain. Barring the probability of a blow in the bay, and sometimes a kick up in the Mediterranean, the voyage was a fine weather one. However, on the last trip I made in her, events seemed to have conspired to make it as unpleasant as possible, and that is where I became a convert to the idea that every ship should have two main boilers at least.

We had one large boiler with four fires, and the two low fires were of course considerably lower than the two wing ones. Therefore the stokehold was made with a pit in it, in order to make it more convenient for the firemen. We carried all Spaniards as firemen and sailors, and found them in general very satisfactory. They wouldn't pass muster in Ontario, because they drank wine at their meals, but we had no very rabid temperance men in the after guard. We occasionally committed the enormity (in these days) of taking a drop of whatever was going ourselves. This pit in the stokehold was the cause of much fluent Spanish cursing in bad weather, as the plates had worn fairly smooth, and the old packet had a very quick roll, returning from the end of the roll with a jerk something like a whip. This had the effect of sliding the fireman at the high fire down into the pit with his shovel full of coal, as often as not when the fireman on the low fires was just beginning to fire his. The result would be a rapid fire of "Caramba" and "Carajjo" and other words which I never caught on to properly, although I acquired a fairly good Spanish vocabulary while in the ship. This pit was only one of the minor discomforts, however, and as it merely affected the firemen, we could afford to discount it. Another feature of the ship was that she had no engine-room ballast tank, and owing to her being long and narow, the space under the engine-room platform, was pretty deep. This became evident when as not infrequently happened, a bilge pump, or both, got choked up, and the water would slap across from side to side of the engine-room with the rolling of the ship. The discomfort in this case reached the engineer, and the swearing was done in English. There was a certain number of minor defects which had become more or less a matter of use, one of the chief being that whenever we ran slow the low pressure go astern guide would warm up very rapidly. We always kept a pot of white lead and tallow with a swab brush in it hanging on the middle platform to correct this tendency. Another thing was the thrust block, which always ran at a temperature that would give an engineer not used to it a severe shock, but which occasioned us little alarm. The middle grating was of the cast iron trellis type, instead of a spar construction, and as there were no rails around the openings for the connecting rods, it became a matter of great agility to walk around in bad weather. A false step, or a slide, would land one in the crank pit. We use to stick ⅝ and ¾ spanners through the holes in the grating at certain strategical spots, against which we could brace our feet while oiling or feeling around. The high pressure gland was another thing that caused some trouble. It consisted of the main gland, which held the usual "Lion" packing, while in the main gland itself, a smaller stuffing box was formed, which was packed with ⅝ round packing. The reason for this I never found out, but it used to give considerable trouble, and the gland was a very difficult one to keep tight. However, any sea-going engineeer knows how one gets acquainted with these little things, and learns how to humor them. I merely mention these items to show that we were not unacquainted with trouble, and would not make any fuss about a little thing. I may add that we were equipped with an old-fashioned condenser, the tubes of which were packed with the old wood ferrule. This frequently needed repacking and didn't always have the sense to wait till we got to port.

The reader may think I am a long while coming to the point, but whenever I think of that old hooker reminiscences rise up like the foam on the beer used to in the days when we could get beer. Well, to come to the point at last, we left Liverpool on the eventful voyage I started to tell about, about 8 p.m., on a fine September evening. We had a full cargo of good Lancashire coal and some other odds and ends, the after-hold having a consignment of soap, lye, and other goods of that kind in the lower tier. Our troubles started just about the time that we were going through the dock gates. We had been at the starting gear for about half an hour, and the engine-room was pretty hot, so we were looking forward to getting clear of the dock gates and under way. Just as the full-speed-ahead was rung down, with the three rings signifying we were all clear till the pilot station was reached, the hum of the fan engine suddenly ceased. I was at the reversing gear, directly in front of the fan, and turning round, beheld the eccentric rod of the fan engine hanging down vertically from the eccentric strap, instead of being in its natural position supporting the valve spindle. Knowing we couldn't keep steam long without the fan, I rang up Stand-by to

the bridge, and sent the third to the store-room to get the spare spindle, which was kept there. The chief came running down to see what the trouble was, and departed post haste to inform the bridge. They rang down slow which was perhaps as well, as we were going slow already, having in mind the fact that we had to keep the pressure up somehow. This was not a very bad accident, but it was not a good start for a voyage. We took the valve chest cover off, got the broken spindle out, and connected up the new one in about half an hour, and before we got very far down the Channel all was well again. The pilot was dropped off the Nor'west Lightship about 12 p.m. and we were well away, with a false feeling of security which was soon to be rudely dispelled.

The Trouble Goes On

When I went on watch at 4 a.m. it had begun to blow pretty hard, and a nasty sea was kicking up. The old packet was behaving fairly well, and the third reported nothing untoward during his watch, except that the water level in the boiler seemed to be about the same as when he started his watch. I didn't think much of this, because we had not been under way long enough for the various little leaks to start, and furthermore, the H.P. gland was apparently perfectly tight. In fact it was too tight to suit me, and I had a careful look at the rod before taking over the watch. My greaser, an old hand, went over everything very carefully and pronounced everything "Bueno," so I lit my pipe and strolled up and down the platform thinking of the girl I had left and the one I was going to meet. As the watch wore on the weather got worse, and I spent some time up in the store-room seeing everything was secure. About 6 a.m. the carpenter came down and marked his hieroglyphics on the sounding board, which showed a litle water in the afterhold bilge, but nothing unusual. The after peak also held its accustomed morning dose of water. I went down the tunnel and found everything as well as could be expected, and even the thrust had not yet got really warmed up. Things were going fine, but just about then I began to feel that there must be something wrong. It seemed to me that there was more water in the boiler than when I went on watch, but I couldn't be sure, and so I got the salinometer pot and drew a pot full of water. I tried the salinometer in it, and found it floated at just a little below the zero. As we had filled up with fresh water before leaving, this was disquieting, but I decided to wait till after breakfast and confirm my suspicions. At breakfast I told the chief my fears, and he said it was all nonsense, and couldn't be. I fervently hoped he was right, but after having a smoke and going along to ask the mate how his head was this morning, the chief and I went down below, and now I was sure that the boiler was gaining water. By this time we were getting down below Holyhead, and running into a nasty head sea. We decided to let things go till noon, and then try the density again, and if it was still going up we should have to stop and put in some ferrules or plug a broken tube whichever it might be. Noon came and the salinometer confirmed our fears, so we decided that we would have to stop. This was no sweet job, with a sea running the way it was, and a conference was held with the "Old Man" to see if he could run in anywhere while we made repairs. He decided that he could hold her head to sea with the aid of what Kipling's hero, "McAndrews," called a "jigger grimed with smoke," till we were through. He passed some caustic remarks about engineers who neglected their work in port and had to do it at sea, but the chief didn't stop to argue as he might have done. Well, we stopped, and got the door off the after end of the condenser, tested it, and found four ferrules gone.

Ye Olde Wooden Ferrule

The usual procedure common to the cult of the wooden ferrule was then gone through. That is, a number of ferrules were soaked in boiled oil, and then forced through a bushing by a hand press, after which they were ready to be put in place. I may say for the benefit of those who have not wooed the wooden condenser ferrule, that they do not all come out of the press as they go in. Some come out in halves. The theory of the press is roughly thus: "If the ferrule can stand what it gets in the press, it will stand up in place." This theory is not given in any of the recognized text books, but is worth considering. I may say that by the time the ferrules had been replaced and the condenser tested, and the door put back, it was just about time for me to go on watch again.

Before we got away, we had several messages from the bridge to say that the wind was freshening, and the tide seting us inshore, and could we please hurry up and get under way. In answer to these communications the chief invariably "sent his compliments to the captain, and desired to say that we were doing our best." When we did finally get under way again, and I went up to have a look at things on deck, it was blowing a fresh gale, and the Welsh coast looked very close. As a matter of fact it was, and before the night was over, we spent a couple of very unpleasant hours wondering if we were going to continue our voyage or pile up on the rocks: Luckily nothing broke down during that time, or we certainly should have left our bones bleaching on the Smalls, but as it was we got through with some anxiety and a loss of a little more sleep. I came off watch at 8 a.m. the second morning out, promising myself to have a good breakfast and then turn in. The conversation over the breakfast table turned on the idiosyncracies of our floating home and the chief, who was an optimist by nature, was in a hopeful mood. He inclined to the view that having performed so badly at first, and then rallying greatly when we were in dire need, that she would now carry us out to Genoa without further mishap. Personally, I had no such hopes, but not wishing to seem unduly pessimistic, kept quiet.

Worse and More of It

I turned in as I had promised myself I would, and had a good sleep until noon, when I turned out for dinner. The chief was not looking so happy as he had at breakfast time, and on enquiring the reason, he told me his fears. "I am anxious about that main feed pipe joint," he said, quietly.

Now I fear I must digress somewhat while I explain about this feed pipe. The main check valve, which was of brass, had a spigot which entered the shell of the boiler and turned up, and communicated in turn with a patent feed heater and circulating arrangement which was contained in the boiler. Now the brass spigot had resulted in some corrosion round the edge of the hole through which it passed, and the face of the pad on the boiler head to which the check was bolted had been more or less pitted. This joint required making every voyage, and the superintendent had promised that we would have a new pad fitted on the boiler and the spigot arrangement altered. This had not been done. The joint had been made in Liverpool, and was presumably good for a voyage. We had noticed a slight weep when getting up steam, but it had taken up and we thought everything was O.K. Now, if a joint on the outside of the check, that is between the check and the pump had given out, we could simply shut off the main feed pipe, and feed through the donkey check. If the joint on the boiler shell went, we had no alternative but blow down the boiler. We were getting pretty well out in the Bay by this time, and the wind and sea both keeping up, so the prospect of a job like that was discouraging.

The chief suggested that after dinner we should go down below and have a look at the joint, and see if anything could be done to prevent it getting any worse. Dinner over, we paused only long enough to fill and light our pipes, and down we went. The first glance I got at that joint convinced me that it was a case of blowing down, because if we didn't do it, when that joint went it would do it for us. There was a nasty dropping all round the edge of the flange, and the appearance of it was far from re-assuring. What should be done, was the next question. We decided first of all to feed through the donkey check for a while, hoping that by easing up, the vibration of the check lifting that we might prolong the life of the joint. We did this, and then tried the old device of tapping in fine wooden wedges all

round the edge of the flange, which of course swell when they get damp, and will often effect a temporary repair. I have seen it worked all right on a manhole door joint, as well as other kinds. Of course it is no good where there is dry steam. Well, this seemed to help matters a bit, and telling the third to keep a close watch on the check, the chief and I went up the ladder again and went into his room to talk things over. We both badly wanted to get to Genoa without any further stops, because they are a bad advertisement for any engineer, and it is no use trying to excuse oneself by blaming the condition of the ship.

We came to the conclusion that while it might help out for a while to feed through the donkey check, it was after all only a temporary arrangement, and precluded the use of the feed heater. Then again if we fed through the main check, even though it leaked somewhat, it meant that we would have to keep the evaporator going to make up the feed we were losing. This would mean frequent cleaning of the evaporator, but we could put up with that much extra work. When we were in the middle of the discussion, the third settled it by coming up and informing us that the joint was leaking worse than ever and he was afraid it was going to blow out altogether. Off we went below again, and found that instead of dripping, the water was now squirting out in great shape between the wedges, and it was only a matter of time till it went altogether. I went off to get the donkeyman to light up his donkey boiler, which was on the main deck, while the chief went to break the agonising news to the Old Man that we had to stop again. I wasn't there, but from all accounts the Old Man went nearly crazy. When he finally understood that not only would we be stopped, but that we would be absolutely helpless as far as the main engines were concerned for probably 24 hours he calmed down and became the efficient sailor once more. That's one thing about that ship, every officer on deck was a sailor, and not a steamship man alone. They had all pulled on the braces in their time, and they all knew whatever was to be known about handling a ship in a heavy sea, whether she had steam, sail, or neither. They went about their preparations, and we said we would give them warning before stopping, or at least the chief said so. We wanted to keep the main boiler going until we had steam on the donkey boiler, as otherwise we would have the bilges full, and no steam for the steering gear. That steering gear was another curio, but it has no relation to this story.

Fortunately we had a donkey boiler which could raise steam pretty darned quick, and it was on the main deck away from the engine room. My donkeyman was a treasure, and could be safely trusted once he understood what was wanted. When he heard what was going on he commended himself to his particular saints, and then went on with the job. The third in the meantime was carrying out his duties under a continual spray from the check valve joint, which was getting worse and worse. He expressed himself very freely to me on the subject of the profession of marine engineering, and I gathered from his remarks that anyone who was fool enough to go to sea for a living deserved anything that might happen to him while there. This is a frame of mind frequently found under similar circumstances, so I agreed with him, and thought no more about it. There wasn't time to think much because just about two minutes after that the joint finally gave way, and we had to retire for a moment or two and let the hot water have its way. We left the engines running to work the steam off the boiler, and dodged through into the stokehold to get the fires drawn. Now this sounds very easy, but just imagine what it meant—the ship labouring in a heavy seaway, the engine-room full of boiling water, and four big fires to pull out on to the stokehold floor. The water from the boiler was of course going into the engine-room bilge, and the bilge pumps were taking some of it away, but of course the main engines had slowed down with the drop in pressure, and the pumps couldn't handle the water very well at that speed. We ran the main engines until they wouldn't turn over any more, and then opened up the easing gear on the safety valves to work off the rest of the pressure. We had steam on the donkey boiler by this time, so that the steering gear was available for our long-suffering friends on deck in their endeavour to keep us head on to the sea. Down below we were working strenuously to get the valve adrift and the face cleaned up so as to make a new joint. It was no soft job at that, with everything red hot, and the antics the ship was kicking up. The bilges were still pretty full, and every now and again a wave of greasy water would come up over the platform we were working on, as a gentle reminder to put the ballast donkey on again and pump them out.

I have had some pretty rotten jobs at sea, but I don't remember anything that was much more uncomfortable than that engine room while we lay there without any steam, and under all the accompaniments of a gale of wind in the Bay of Biscay. We tried first of all to make a hurry-up repair of the job by sewing it with lead wire between the studs, in order to save taking it off. This resulted in a delay of about two hours, between making the joint and filling the boiler and testing it. Of course it leaked and we had to go to work again and do what we should have done at first, that is take the valve off the boiler, and do the job right. We were there altogether, between the time of the joint blowing out and getting under way again, about twenty hours, and believe me they were twenty mighty uncomfortable hours.

The Case for Two Boilers

Now what I want to emphasize is the fact that if we had had two boilers instead of one we could have kept jogging along with the one boiler while we made the repair on the other, and though progress would have been slow it would have been progress. We should not have been lying helpless, the toy of every wave that came along. Looking at it in another way, if that joint had blown out when we were trying to claw our way off a lee shore, we should have all been lost, because if we had gone ashore on that coast under the conditions of wind and tide that prevailed we should have broken up in short order.

A plant ashore with one unit may be put out of business for a short time and lose some money, but there it ends. A plant afloat that depends on one boiler is in a precarious state if anything happens to that one boiler. Therefore I say if there is any question as to between fitting one or two boilers, fit the two, and you have that much insurance for the extra cost. There are cases, of course, where there is no choice, such as in certain types of tugboats, and then in larger types of steamers there are always more than one boiler. If anyone doubts the advisability of fitting more than one boiler where it can be done, let him try being hove to in a gale of wind in the Bay of Biscay while he makes joints on the back plate of his one boiler. His vote will thereafter be for two or more.

HYDRAULIC PROPULSION OF SHIPS

Extremely interesting experiments are now being carried out on the Thames in two British systems of hydraulic propulsion for ships. In each of these systems the propulsive effect is secured by the reaction of a jet or stream of water produced by a pump. The principle has been familiar to marine engineers for many years, but in these new applications a promising effort is made to obtain much higher efficiencies than have yet been secured. In one system the water is drawn into a cylindrical casing by rotating propellers and ejected to the rear, arrangements being made to keep the in-going and out-going streams of water separate. Speed control is obtained simply by rotating the inner drum of the casing. A launch driven on this system attained a speed of over 5½ knots, with an engine of 7¾ horse power.

Vancouver, B.C.—The British Columbia Marine Engineers, Ltd., launched the schooner "Lady Kindersley" for the Hudson's Bay Co., specially built for the Arctic trade. She is 635 tons gross, being 200 ft. long, 36 ft. 3 in. beam, and 15 feet molded depth.

The Vickers-Petters Hot Bulb Engine*

A Six Cylinder Hot Bulb Engine For Marine Use—Circulating and Bilge Pumps Worked From Main Crank Shaft—A Novel Device for Producing Ignition When Starting Cold

WE recently had an opportunity of inspecting one of the largest two-cycle hot-bulb marine engines which has been constructed in this country while it was running on the test bed. This engine, which is illustrated by the accompanying half-tone and line engravings, has been constructed by Vickers-Petters, Limited, of Ipswich, for installation in a vessel which is to ply to Greek ports, and is of 450 brake horsepower. On the occasion of our visit it was being tested against a hydraulic brake, and it was noteworthy that even when fully loaded there was not a great amount of noise, while the exhaust was of a pale grey color; there was no black smoke. The normal speed is 250 revolutions per minute, but when reduced to 150 revolutions per minute the engine still runs steadily.

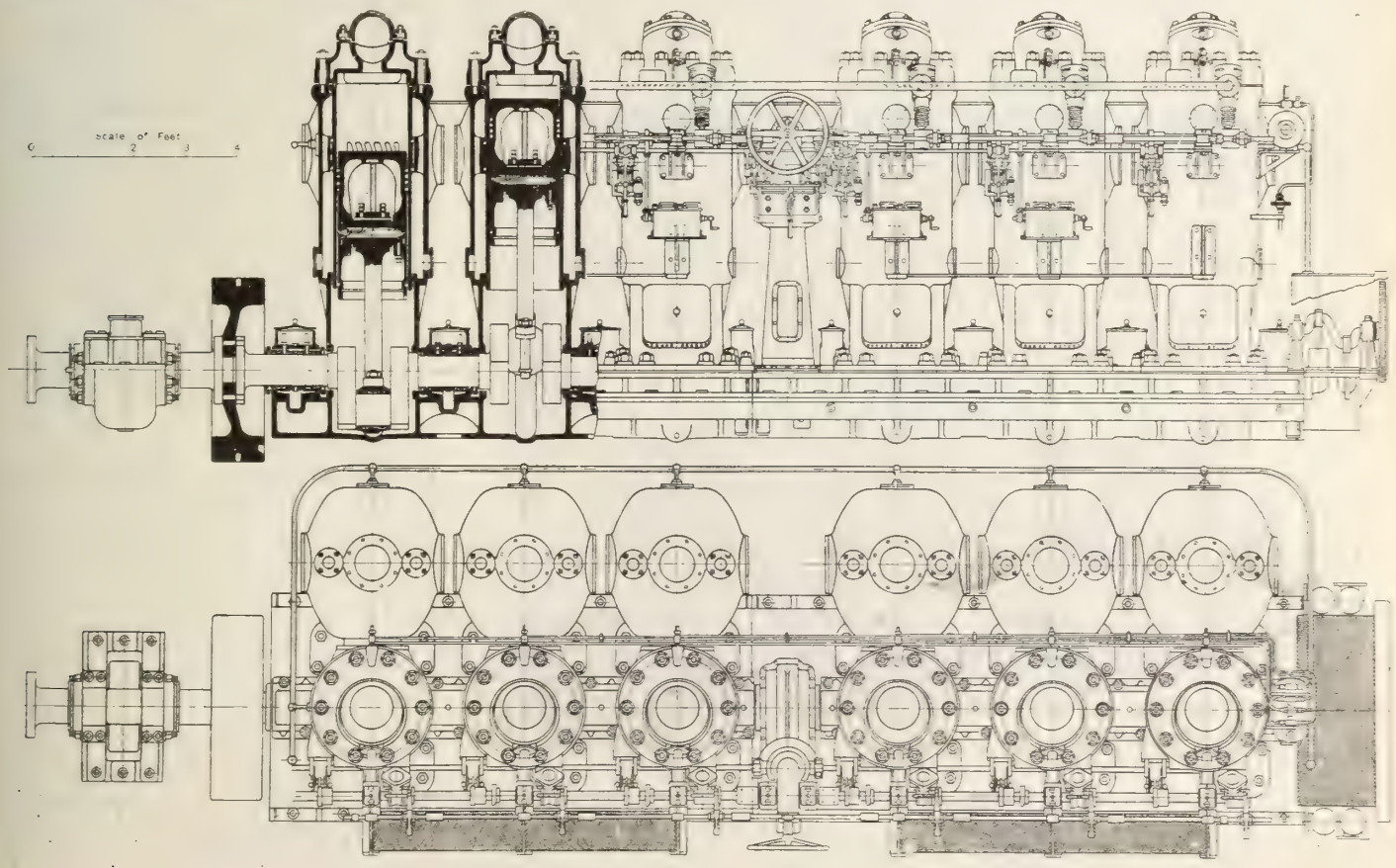
The cylinders are 16 inches in diameter by 18 inches stroke, and each one is cast separately. The general design follows the usual practice of the makers, and is so well known as to require little detailed description here, but there are several new features which need explanation.

*Courtesy of the "Engineer."

One of the first features to attract attention is the set of circulating pumps, arranged at the forward end of the bedplate. A detail drawing of these pumps is given above, and the casing with which they are covered is plainly seen in the half-tone engraving. There are four pumps, three of which are used for circulating purposes, while the fourth is a bilge pump. They are driven by two crank shafts, which, in turn, are worked by spur gear from the main crank shaft. The gear is arranged to reduce the speed to about 80 revolutions per minute at the pumps. The valves are of the ball type. The result is that the pumps run quietly, and should continue to do their work with decidedly dirty water. The pipe connections are so arranged that each of the three circulating pumps delivers cooling water to the jackets of two cylinders and their silencers.

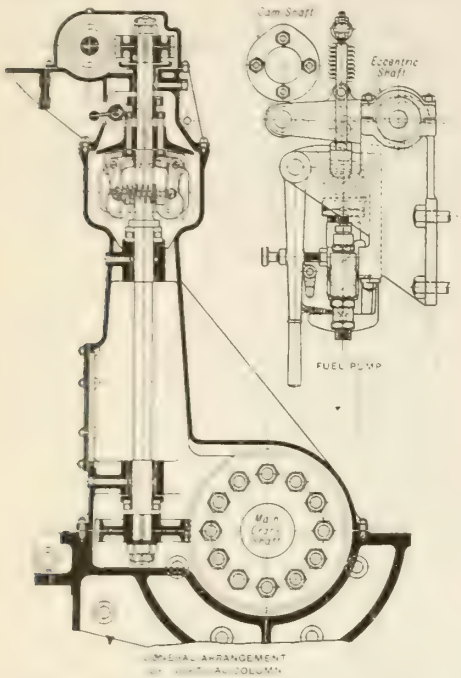
Another characteristic of the engine is the large open space between the cylinders, which permits the use of outside main bearings and greatly facilitates the removal of the keeps for overhaul. The bearings, as will be seen from the line drawing, are of a good length, and are fitted with syphon lubricators. The big-end bearings also are easily accessible through the square doors in which the air inlet valves are fitted. The crank shaft is in two pieces, which are exactly alike. That is to say, each half has two coupling flanges, so that they can be interchanged if necessary. The cranks on each shaft are set at 120 degrees, and a very even turning movement is produced.

Between the two groups of three cylinders there is a vertical column carrying the manoeuvring gear, of which we also give a detail drawing. Rising up through the centre of this column there is a vertical shaft, which is driven by worm gear off the crank shaft, and is used to drive the cam shaft. It is also furnished with a centrifugal governor, which checks the engine when the propeller races. This governor, and the ordinary hand control, act by regulating the stroke of the fuel pumps, of which there is one for each cylinder. In the drawing of one of the fuel pumps it will be seen that the plunger is operated, by its cam, through the intervention of a rocking lever. The fulcrum of the lever is an eccentric on a shaft which runs, in brackets, along the whole length of the engine. By rotating



ELEVATION AND PLAN OF ENGINE

this shaft, either by hand or the governor the throw of all the fuel pumps can be simultaneously varied from full stroke to nothing, and the speed of the engine thus controlled. Each of the pumps is also equipped with a hand lever for giving an additional injection if required. Double

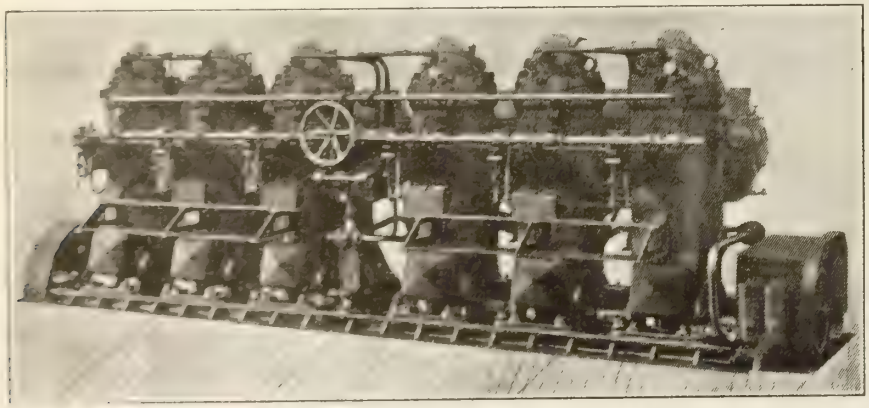


MANOEUVRING GEAR AND FUEL PUMP

valves are fitted on the suction side of the pumps. On the delivery side there is a single valve, with another at the spray. Helical springs are used to keep the rocking levers up to the cams, and we noted that even when the engine was allowed to race there was very little of the rattle generally associated with cam gears.

For manoeuvring purposes, compressed air is supplied to all six of the cylinders. The air valves are plainly seen in the half-tone engraving, just above the cam shaft and behind the air distributing pipe. The cams for operating the valves are on the same shaft as those for the fuel pumps, but are a sliding fit and are driven by feathers. A rod running parallel with the cam shaft has fingers engaging with the air cams, and can be moved lengthways by means of the hand wheel at the top of the centre column. The longitudinal movement of the cams brings either their ahead or astern faces opposite to the air valve tappets, and admits air correspondingly. As there are six cylinders, it will be readily appreciated that there is always at least one cylinder in a good position to start the engine, and that barring round is quite unnecessary. The fuel control lever is directly beneath the reversing wheel, and the main air valve below it. The driver can thus manoeuvre his engine without moving from the central column, and it is remarkable with what rapidity reversal can be effected. The air for starting the engine is stored at a pressure of from 150 pounds to 200 pounds per square inch, and manoeuvring can be carried on, we understand, with pressures down to 65 pounds.

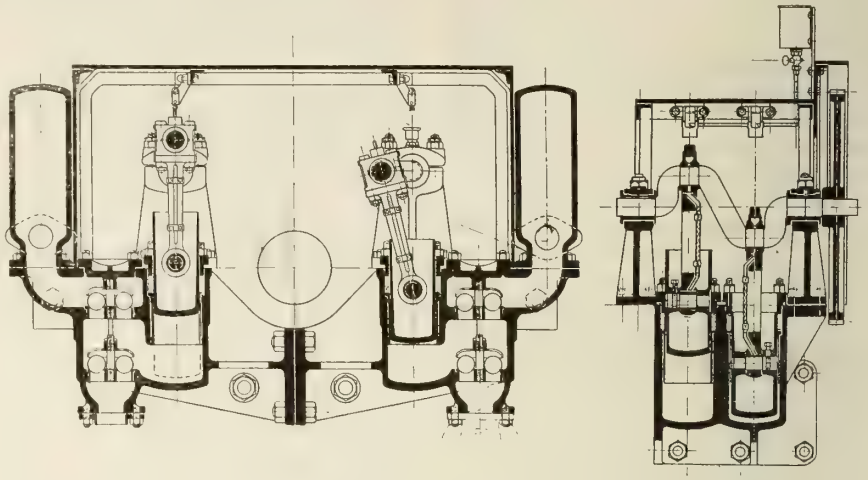
On first starting up the engine it is, of course, necessary to heat up the combustion heads, and this is done by means of burners supplied with paraffin and air under pressure. The burner is of such a form that it is unnecessary to give it a preliminary warming, and starting can, in consequence, be effected very rapidly. The container for the paraffin can be seen in the engraving, on the side of the forward cylinder.



150 H.P. HOT BULB ENGINE

Oil for lubricating the cylinders is provided by four mechanical lubricators, fixed in front of cylinders Nos. 2, 3, 4 and 5, which have sight feeds and force pumps. They are driven off the main cam shaft. A Michell bearing is fitted to take up the thrust of the propeller, but there is no clutch, as the engine will manoeuvre while connected right through to the propeller.

While we were at Ipswich we watched an engine being started up by a new system which is being perfected by Vickers-Petters. With this process a hot-bulb engine can be started up from cold, on heavy oil, without the use of a blow lamp. In the combustion space there is arranged a small coil of nichrome wire, which can be heated by means of the current supplied by a small storage battery. In about one minute this coil can be raised to a temperature sufficient to ignite a charge. As soon as an explosion has been produced and the engine started, the current can be switched off, as the explosions will keep up the temperature of the coil. A few minutes afterwards the whole of the combustion head will have been warmed up, and the coil is no longer required. It is then withdrawn into a recess by means of a screwed stem, and is protected from the effects of continued exposure to the hot gases by a cover coming down on to a valve seating. The engine can be started in a minute and be running normally in three.



CIRCULATING AND BILGE PUMPS

LARGEST AEROPLANE ENGINE ON RECORD

Great Britain claims the credit of having built the largest aeroplane engine on record. Recently there was tested in a factory near London, England, an engine which developed over one thousand horse power. This engine, which was built to the order of the Royal Air Force, has sixteen cylinders, weighs close on one ton, and is most economical in fuel and oil consumption. Its influence on the range, speed, and carrying capacity of aeroplanes is expected to be considerable, and its performances in the air are awaited with the keenest interest by aviation experts.

MARINE DEPARTMENT FIGURES

Adverse changes have occurred in the ship and boatbuilding industry in the interval since 1919, for which year's operations data have just come to hand from the Dominion Bureau of Statistics, Ottawa. The shipbuilding plants on both Atlantic and Pacific coasts are engaged in finishing contracts on account of the Department of Marine for the Canadian Government fleet. Otherwise there is a dearth of orders for shipping and the outlook is not particularly bright. The world now finds itself with a surplus of shipping, or, more strictly speaking, a shortage of freight for ocean shipment. A large aggregate of tonnage is now lying idle for want of business, and sales of vessels are being effected at prices considerably under present production costs.

The former German vessels have been and are being disposed of at sacrifice prices, and the shipbuilding industry the world over is suffering from depression. Under such circumstances it goes almost without saying that the Canadian shipbuilding industry presents an aspect of much less activity than in the comparatively rosy days of 1918 and 1919, when all the large shipyards of the Dominion were actively engaged on the construction of vessels for the Canadian Government Merchant Marine.

Extent of Operations

The shipbuilding program undoubtedly served a most useful purpose in aiding to bridge the early period of transition and prevented a larger amount of unemployment than would otherwise have occurred. The report covering the operations of 78 shipbuilding plans during 1919 shows that wages aggregating $29,836,848 were paid to 25,260 male and 169 female employees, while boat-building plants paid wages amounting to $920,441. There are in addition quite a number of dependent industries supplying marine boilers, engines, lumber and other material for outfitting the vessels. The capital invested in shipbuilding plants was given as $70,854,028, of which $29,911,885 was for Ontario, $27,614,498 for Quebec, $6,541,000 for British Columbia and $6,732,419 for Nova Scotia. The amount invested in boat-building plants was $1,260,663.

Wage payments of $30 a week and over were paid to 5,225 workers; there were 3,495 men receiving from $24 to under $30, and 4,979 receiving from $20 to under $24, according to a classification of employees, according to certain specified groups of weekly wage payments, as at December 15th, 1919.

Fuel consumed was $956,610 in shipbuilding plants and $17,125 in boat-building plants. Of the total $641,480 was of Canadian origin and $332,255 was imported.

Materials and Production

The tonnage of steel plates and shapes used was 90,227, giving a cost value of $10,523,154. Boilers and engines cost $6,908,482. The lumber bill amounted to $2,314,339 and timber to the value of $1,579,896 was used. The total cost of materials for shipbuilding plants was $35,969,327, and for boat-building plants it was $587,624.

The production of Canadian shipyards included the following: 14 war vessels valued at $4,742,936; 49 steel steamboats at $37,466,996; 63 wooden steam vessels at $20,307,561, and 38 wooden sailing vessels at $1,937,303. Repairs to vessels and boats during the year, including custom work, amounted to $8,282,914. Vessels being built but not launched during the year numbered 43, valued at $9,176,101.

The gross tonnage of the 181 vessels completed and in course of construction during the year was 2,604,539, and the net tonnage was 1,216,602.

THE "PRINCE RUPERT" SALVED

The accompanying photograph shows the fast Grand Trunk steamer "Prince Rupert" as she appeared on the rocks at Genn Island near Prince Rupert, B.C. She struck a rock and was beached at Swanson Bay in such a position that she was totally submerged at high water, for a matter of two and a half months. She was salved by the Pacific Dredging Company by means of coffer dams, the work taking about two months, and was brought down to Vancouver after floating under her own steam. Incidentally she accomplished the trip in something less than her regular schedule time. She was taken to Vancouver, and the repair work was entrusted to Yarrows Limited and was placed in the dry dock at Esquimault for the necessary work on the hull to be carried out. The repairs necessary amount almost to a complete rebuilding job. Messrs. Yarrow have now their hands full of repair work, all their space being occupied by steamers under repair and overhaul.

THE "PRINCE RUPERT" ON THE ROCKS

LAUNCH OF S.S. MIRAFLORES

On the 12th March, in the presence of a numerous company, there was launched from the Wallsend Shipyard of Swan, Hunter & Wigham Richardson, Ltd., a finely modelled fruit-carrying ship, which, on leaving the ways was named Miraflores by Mrs. Ash, wife of Mr. A. E. Nash, a director of Messrs. Esplen & Sons, Ltd., of Liverpool, who are the consulting naval architects and engineers acting for the owners, the Atlantic Fruit Co., of New York. The Miraflores is a sister ship to the St. Mary, which was recently launched by Swan, Hunter & Wigham Richardson, Ltd., from their yard at Southwick-on-Wear for the same owners. These ships are of the shelter deck type and are built to the highest class of Lloyd's Register.

The leading dimensions of the Miraflores are: 270 ft. in length between perpendiculars, with an extreme breadth of 39 ft. and a depth of 25 ft. to the shelter deck. The triple expansion engines and boilers are being built at the Neptune Works of Swan, Hunter & Wigham Richardson. The boilers are designed to be fired with either oil fuel or coal, and the tanks in the double bottom of the ship can carry either water ballast or oil fuel.

The seamen and firemen will have comfortable accommodation in the after part of the ship, while the officers and engineers are housed in a deck amidships. Cabins for the captain and his chief officer will be fitted underneath the navigating bridge and below these quarters the dining saloon is placed. The forward and aft holds of the ship will be insulated for the carriage of fruit.

Chicago.—It has been announced that two steamers have been chartered to convey the members of the Rotary Clubs of Canada and the United States to the International Association at Edinburgh, in June. The Rotarians will sail on June 1st.

MARINE ENGINEERING
OF CANADA

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World.

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A Hopeful Sign

IN another portion of this issue is an item calling attention to some considerable reductions in the price of steel by British steel makers, and their probable effect on the shipbuilding business. The manager of Messrs. Cammell, Laird, one of the largest shipbuilding concerns, in a speech at the annual meeting of the company, said that he had no doubt that a substantial reduction in costs would be followed by a number of orders. This shows that in spite of the talk of over-production of ships and the undoubtedly large number of vessels laid up at the present time, many owners are anxious to replace vessels lost, or old vessels, by more suitable craft. There is no doubt that a large number of the ships carried on the registry to-day would have been out of commission years ago had it not been for abnormal conditios. Now that owners want to replace these craft they find that costs are prohibitive, so that they are content to lay low and wait for a more favorable period to build in. In this connection it is noteworthy that ships can be built in Germany for half the cost of those built in the United Kingdom. As steel is the most important item as far as material goes in the building of a ship, these reductions, of which the latest is the third since November last, should go far towards correcting these conditions. It is a noteworthy fact that while there are 29 per cent. of the U. S. merchant marine, and 20 per cent. of the Scandinavian countries' ships laid up, there are only 9 per cent. of the British vessels tied up. This would seem to bear out the statement of Mr. Hichens and others that a sufficient reduction in building costs would induce a number of orders.

It has been necessary for one large firm of Canadian steamship owners to recall a number of vessels from ocean service to the Great Lakes service. There should be some building necessary to replenish the lake fleets in the near future. Canadian yards should have a good chance to secure business of this kind and so hold their plants and organization together until more ocean ships are built in this country.

The Season Approaches

THE indications are that navigation on our inland waters will be well under way by the early part of April, and although there is as yet no great demand for space, a number of steamers have started to load. The operating of navigation should ease up the unemployment situation considerably, as wherever there is a wharf and ships calling a certain amount of labor is required. In large ports like Montreal the opening of navigation after the long winter's idleness is a boon and a blessing to hundreds of families, and its effect is usually felt throughout the whole retail section of the city. The same thing applies to practically every centre of shipping that is closed up by ice for a goodly portion of the year. The work of preparing the port and getting the steamers that have wintered in the port ready for the season provides employment for some time before navigation actually opens, and after the cargo fleet has been prepared and got away it is time to freshen up the passenger fleets and put them into commission. An active shipping business is a great asset to any community, and its benefits are often felt by those who do not know a ship from a barge.

A Voluntary Tribute

A REPRESENTATIVE of a British shipping firm recently paid a compliment to the management of the Canadian Government Merchant Marine. His attention was drawn to an announcement of a reduction in freight rates by the Government line, and his comment was: "I am sure they have not done that without previously making arrangements with the other lines. The C.G.M.M. have never resorted to freight cutting in order to get business." This is, to our mind, a tribute to the safe and sane management of the line and is very different to the attitude adoped by the U. S. Shipping Board in their administration. The C. G. M. M. seems to us to be the one bright spot in the field of government ownership, and it is because it seems to be left strictly alone by the politicians, and managed from a shipowning instead of political viewpoint. It is evidently the exception that proves the general rule that anything done by a government is done badly.

THE British Board of Trade has issued a statement dealing with the loss of ships and lives in the vicinity of the British coasts during the period included between July 1st, 1914, and Dec. 31st, 1918. These vessels are such as were registered under the British flag, and include vessels registered in the overseas Dominions and India. The total number of vessels lost was 4,696, with a tonnage of 9,412,275. Of this total 80.5 per cent. of the number and 86.8 of the tonnage was lost due to enemy action. In enumerating the loss of life it is interesting to note that the loss of life from enemy action and the loss due to maritime casualties were about equal. In both cases the loss of lives among the crews was much greater than among the passengers. The figures are as follows:—Deaths due to causes other than enemy action, seamen 10,975; fishermen 459; passengers 7,466; total 18,900. From enemy action the numbers were: Crew 14,428; passengers, 6,330; total 20,578. Fishing vessels: Crew 1,127; passenger 1; total 1,128. Additional deaths included four seamen killed by bombs from enemy aircraft, 67 who died while prisoners of war in enemy countries, and two released prisoners from Germany died in Holland after removal from Germany. The total number of deaths covered by the report was 40,680.

News of The Shipping World

THE Norwegian Government has taken up with the State Department of the United States Government the question of compensation for the tonnage building in the United States during the war for Norwegian owners which was requisitioned by the U.S. The total amount involved is said to be in the neighborhood of $14,000,000. The attempt to obtain reimbursement from the U. S. State Department has been going on a long while, in fact for the whole of last year, and the Norwegian Government has now decided to try and obtain arbitration of the claims.

* * * * *

NAVIGATION on the Great Lakes is expected to officially open on the 1st of April, from which date underwriting of ships and cargoes will be in force. The indications for the present are that business will be very quiet, and there are good reasons for so thinking. The mild winter has resulted in many dealers and railways in Canada having large stocks of coal on hand, which will, of course, militate against any great demand for coal space. There has been so far no indication of a demand for space for iron ore or grain, although there is a good deal of the latter at the head of the lakes.

* * * * *

THERE has has been another reduction in steel prices in the North of England, making the third reduction since November last, and shipbuilding interests in the Old Country look on this as a favorable omen for their business. In this connection it was stated at the recent meeting of Messrs. Cammell, Laird & Co. that there had not been a single shipbuilding order placed in the country for the past six months, but Mr. Hichens, the general manager of the firm, said that he believed that with any substantial reduction in costs there would be plenty of orders forthcoming. This opinion is shared by other shipbuilders, so that the news of a reduction in steel must be very welcome to these gentlemen.

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SOME interesting figures are now available, and have been published, with reference to the number of ships laid up, and the total tonnage thus made idle. It is stated on the authority of statistics compiled by the Chamber of Shipping in England that there are no less than 5,000,000 tons laid up in the United Kingdom, the United States, and Scandinavia. It is pointed out that a large proportion of these, at least on the Eastern side of the Atlantic, are old ships that would have long since been scrapped had it not been for the abnormal conditions arising out of the war. It is confidently expected that these vessels have now been laid up for the last time, and will probably not be replaced. Then again the large wooden tonnage of the United States may be counted out, as it is highly problematical if any use will ever be found for any of these ships. The wiping out of these old ships will undoubtedly be a help in stabilizing the situation, but there is still a large number of ships in excess of the demand, and there are about 7,000,000 tons now under construction. All this points out to a curtailment of building plans for some time to come. The percentage of tonnage laid up of the different fleets is a commentary on their ability to meet hard times. Thus out of the total U. S. tonnage 21 per cent. is laid up, the Scandinavian nations have 20 per cent. laid up, while the British have only 9 per cent. of their ships out of action.

THE "Bismarck" the largest ship in the world, has now been sold by Lord Inchape to the White Star Line, and will soon appear on the New York run. This sale following the sale of the "Imperator" to the Cunard Line not long ago, puts the two largest of the late German fleet under the British flag. The "Leviathan" which was allotted to the United States has lain at her wharf for the past eighteen months, all efforts of the U. S. Shipping Board to dispose of her having been fruitless. The largest passenger liners in the world are therefore now under the British flag and represent a fine array of names. The "Aquitania," "Olympic," "Mauretania," are all names famous by their service in war, and the "Imperator" and "Bismarck" now to be named the "Majestic" in unison with the other names of the White Star Fleet, are well known as being representative of the most ambitious projects of the late aspirants to the leaders of the seas. The British North Atlantic passenger fleet will continue for some years, with these vessels, to be far ahead of any competitors. There is no chance of any more of this type of steamer being built for years to come, as prices for such vessels are prohibitive. The "Leviathan," if she continues to lie at her wharf, will deteriorate very rapidly, and the chances of selling her grow further off every day. It is just as well for the travelling public in general that the Imperator and Bismarck were allotted to Great Britain, apart altogether from the justice of the award.

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THE Liverpool Journal of Commerce publishes the following, which as they say whether true or not, is worth repeating. Here it is:

"The death of Konig reminds one of a story that went the rounds of the United States Navy when the Deutschland first appeared in Baltimore. Quite possibly it is true, but under any circumstances it is well worth repeating. After welcoming her in as a wondrous relief to a particularly dull season, certain sections of the U. S. press brightened their pages with long stories of shoals of Allied cruisers waiting for her departure off the mouth of Chesapeake Bay. The crew had repeated stories of the hairbreadth escapes which they had had on their west-bound passage (they scarcely saw anything of our patrols, but that is by the way) until they had come to believe them themselves, and were getting very uncomfortable about their chances on the return voyage. The newspapers did nothing to make them more comfortable, but their admirers among the German-American population feted them everywhere. One man took half-a-dozen of them up to show them the sights of Washington, and in good republican style trooped them into the Navy Department to show them the models which decorate the passages. By an unexpected chance the door of Mr. Joseph Daniels, the Secretary of the Navy, was left unattended, and the leader of the party actually had the impudence to push his way in, the half-dozen Germans following him like sheep. Mr. Daniels looked up, took in the situation at a glance, and without a word got up from his chair and led them to the opposite side of the room, where a very tattered remnant of a Stars and Stripes was framed. "This, gentlemen, is all that remains of the U. S. submarine F. 4. Her crew died in agony." And without another word he bowed them out of the other door. The expression on the faces of those Germans as they came out kept two strongly pro-Ally officers who happened to be passing cheerful for a week after."

PACIFIC coast ports gave a rousing welcome to the Canadian naval squadron, consisting of the light cruiser Aurora and the destroyers Patricia and Patriot, and at Victoria, Esquimalt and Vancouver officers and men were afforded a continuous round of entertainment. The ships are still anchored in Esquimalt harbor, and it is expected that they will commence the return voyage to the Atlantic seaboard April 13. No drydocking will be done while the ships are on the Pacific coast, although the facilities at Esquimalt will enable the vessels to undergo a fairly complete overhauling. Among those who welcomed the squadron at Victoria was Captain Walter Hose, R.C.N., director of the Canadian naval services.

High railway rates are likely to exercise an important influence in building up water-borne trade between the ports of British Columbia and the Atlantic coast. Advantage of the situation is already being taken by several companies operating between the two coasts, notably the Canadian Robert Dollar Company and several lines making Seattle their Pacific headquarters, and word now comes that the Williams Steamship Company, of New York, is considering a project to establish a line of steamships operating from Eastern Canada to British Columbia via the Panama Canal, the Atlantic sailings being from Montreal in summer and from St. John in winter.

Lumber operators are also planning to make increased use of sea tonnage instead of the rails in eastern shipments. The Weyerheuser Timber Company is building a lumber storage yard at Baltimore, M.D., with a capacity for one billion feet of lumber, and it is stated that 40,000,000 feet of lumber will be shipped by this company to its new base in the east within the next few weeks from Puget Sound and Vancouver Island ports.

Sailing craft of every type and rig will soon be coming into their own again as a result of the high cost of operations of steamships, according to Carl Sunde, of the Sunde & D'Evers Company, of Seattle, who has outfitted many vessels for overseas voyages. "While fuel oil, coal and steamship supplies are soaring, the wind is just as cheap as it was when the world was created," said Mr. Sunde a few days ago. "I expect to see more of our lumber, wheat and salmon carried by sailing vessels in the future."

The Dominion Government proposes to erect a directional wireless station on the west coast of Vancouver Island this year, according to latest reports from Ottawa. This system has been tried out on the Atlantic with satisfactory results. It enables a station on the shore to give position to a ship lost in the fog or storm. The invention was made during the war. Other changes outlined in the department's annual report have partly been carried out. The closing down of the Ikeda, Pachena and Lazo stations have been announced, and the two former have been closed. Point Grey is devoted to ship-to-shore work, and a new station will be built near Vancouver to act as a terminal for interstation service. This latter work is confined to commercial shore work, and to collecting for privately-owned and licensed stations, of which there are five or six at different pulp, paper and lumber mills on the coast.

The Seattle Chamber of Commerce has instructed a special committee to investigate the possibilities of utilizing the Ferris type wooden hulls built during the war which have been lying idle in Lake Union and never sent to sea. One of the proposals is to equip the vessels with sails and use them in the lumber trade. The ships are now under the control of the United States Shipping Board. The cost of the ships would have to be very cheap to be attractive, however, as charter rates are low. The trans-Pacific lumber rate has been reduced from $12.50 to $10 a thousand. Only a few weeks ago it was cut from $17.50. Westbound cargoes are easy to get, but return freights are scarce.

Boycott against American vessels flying the Shipping Board flag is threatened by Vancouver shippers as a result of the decision that hereafter all cargo board vessels out of Canadian ports would collect United States funds on competitive cargoes. Competitive cargoes are taken to mean lumber, salmon, wheat, flour, etc., while pulp and herring are still considered to be on the open list. Canadian shipping is expected to profit from this situation.

Baron Rempei Kondo, president and managing director of the Nippon Yusen Kaisha, and shipping advisor to the Japanese delegation at the peace conference, died at his Tokyo home February 9 after a short illness. For many years Baron Kondo was recognized as the leading shipping man of Japan and was a big factor in Pacific transportation. His ambition, which he lived to see materialize, was the creation of a merchant fleet carrying the flag of Japan in every ocean.

That the Victoria Shipbuilders, Ltd., are in a precarious position financially and that they will have to receive additional assistance from the Federal Government if they are to continue in business was made clearly evident at a recent meeting of shareholders, when charges of dishonesty, mismanagement and general criticism were freely made. The outcome of the meeting was the appointment of a committee of five shareholders to meet the Dominion Government adjusters now on their way to the coast and present them "with all facts and figures showing the reason for the present condition." This committee was composed of W. Walker, A. L. Grogan, Major P. Riddle, D. Evans and G. Leeming. This action was taken on amendment to the motion submitted by Edwin Tomlin, former secretary of the company, to the effect that "the company advise the Dominion Government that the company is financially embarrassed, and that the present board of directors do resign, and that a request be made to the Dominion Government to advance the money to complete the three ships as shall be ascertained by the Government adjuster and accountant after examinations of the company's affairs. The amendment, on a share vote, carried over the motion by 1,644 to 69 against. President Clarence Hoard read the directors' report, informing shareholders that the barquentine already constructed by the company at the Cholberg Shipyard had cost $92,000 more than the estimate and that Government assistance would be required to carry on with the programme. The Victoria Shipbuilders, Ltd., was organized about a year ago to build wooden barquentines. Largely as a measure to tide over the unemployment situation at that time, the Federal Government advanced $750,000 as a loan and the remainder of the money required was subscribed by the public. It is probable that the affairs of the com-

pany will be debated at Ottawa before any further outlay is authorized.

George M. Bosworth, chairman of the Canadian Pacific Ocean Services, recently passed through Vancouver and Victoria on his way to the Orient. This is his first trip across the Pacific since he became connected with the shipping department of the company in 1882, three years before the company commenced to operate vessels on this ocean. It is understood that on his return to Canada Mr. Bosworth will resign. Mr. C. E. E. Ussher, former traffic manager of the Canadian Pacific Railway, has been named vice-president and will probably have charge of the Canadian Pacific Ocean Services. While in Vancouver Mr. Bosworth stated that before he left the East he was offered a brand new German freighter of 10,000 tons, which had been taken over by Great Britain, for £9 a ton. During the war this class of vessel was being built in Canada at $200 a ton. "I could get all the ships I want, enough to fill your whole harbor, for $50 to $75 a ton," said Mr. Bosworth.

Considerable interest was aroused by recent reports that the Canadian National Steamship Lines would transfer its steamers, operated under the Grand Trunk Pacific house flag, the Prince Rupert and the Prince George, to the California-British Columbia run and that it would bring out two steamers from the Great Lakes to take the place of these vessels in the Prince Rupert and northern British Columbia route. Capt. C. H. Nicholson, general manager of the floating equipment of the National Steamship Lines, returned to the coast from Ottawa a few days ago and was unable to substantiate the story, saying that the project was still indefinite. According to the original report, it was the intention of the company to operate a passenger and freight service between Victoria and Vancouver and San Francisco. It was stated that the Prince Rupert, as soon as repairs are completed, would leave Esquimalt and go on berth for the inaugural run to the South, and that the Prince George would abandon the north and follow the Prince Rupert. At present there is no direct service between Vancouver and California, although Victoria is a port of call for the Pacific Steamship Company's vessels, which ply between California points and Seattle. If the Canadian line decide to carry out the plan indicated it will mark the first Canadian invasion of this field in recent years and will bring Canadian and American steamship lines into direct competition. According to international law it is not permissible for Canadian vessels to carry passengers or freight between two American ports, so that only one California point, namely San Francisco, could be included in the schedules.

Excitement in Prince Rupert marine circles was caused when the Board of Trade of that city passed the following resolution: "Whereas at the last regular meeting of the Board of Trade, Colonel C. W. Peck, M.P., named enemies in Prince Rupert, this board hereby goes on record as endorsing his remarks, believing the situation is as he stated. We know that those gentlemen are not in sympathy in any manner with this port and we believe it would be in the best interests of Prince Rupert and the Canadian National Railway if they were removed from their positions so that they would not be subjected to the inconveniences and hardships contingent upon sojourning in this city whenever it is necessary to visit here."

The men named by Col. Peck were Capt. C. H. Nicholson and Mr. A. L. Brownlee, of the C.N.R. steamship service; Inspector Williams, of the Fisheries Department, and Capt. W. H. Logan, Lloyd's representative.

That he would not be surprised to see direct steamship communication inaugurated in a few months between Vancouver and Liverpool by the Canadian Government Merchant Marine was the statement made in Vancouver a few days ago by General Manager R. B. Teakle. "Commensurate with the development of trade out of this port ships will be supplied by the Canadian Government Merchant Marine," said Mr. Teakle. "In other words, our ships will ply in any service and to any country where cargoes are available. We hear a good deal about trade as far south as South America. Canadian business men are out after it. They are urging us to run our ships to this comparatively new market. I am not given to making promises, but I will say that our policy is to listen to the voice of business men in any community. The fleet is owned by the people and for the people."

A fortnightly service between the Pacific Coast and Europe, to be maintained jointly by the Holland-America and the Royal Mail Packet Companies after April, was announced in Vancouver by F. M. Volk, of New York, assistant general manager of the Holland-America Line. Twelve steamers in all will be placed in this service. Refrigerator space will be provided for apples, cheese and fish. Experimental shipments on the Eemdyk and the Kinderdyk were so successful that the development of the trade was assured. Mr. Volk denied the story that the company contemplates establishment of a passenger service soon. He was accompanied by Col. E. J. Nash, special representative in North America of the Royal Mail Steam Packet Company, and E. Delaney, of San Francisco, agent for the Holland-America Line.

A set of four-cylinder triple-expansion engines capable of developing a speed of sixteen knots will be installed in the new steamer being built by the Wallace Shipyards, of North Vancouver, for the Canadian Pacific Railway's B.C. coast service. In addition to watertight bulkheads, a special design of double bottom will be built to lessen the possibility of bilge damage. The vessel will be placed in commission this fall and is to take the northern British Columbia run, which was served by the Princess Sophia, which was wrecked in the winter of 1918.

Recent developments in the United States Senate strengthen the belief that the airplane mail service between Seattle and Victoria will be continued. An amendment passed by the Senate recently restores the language used in previous post office appropriation bills, and it is believed that the House will make no objection. The language provides that the Postmaster-General may contract with individuals or corporations for "an airplane mail service between such points as he may deem advisable and designate in case such service is furnished at an actual cost not greater than the cost of the same service by rail and shall pay therefor out of the appropriation for inland transportation by naval routes." It is under this language that the Victoria-Seattle and the Key West-Cuba air routes are established. The principal purpose of the service between Seattle and Victoria is to transport mails to and from trans-Pacific liners making Victoria their first and last port of call.

Steady progress is being made in the construction of the new wireless station which the Federal Government is establishing at Bull Harbor, Hoe Island, north coast of Vancouver Island. The plant will be in operation some time this summer.

Passenger service between British Columbia ports and Australia and New Zealand has been suspended pending the holding of a ballot among the seamen. This ballot is being taken to ascertain whether the union will give a contract with the shipowners of Australia that no such event as the stewards' strike will be allowed to interfere with the entire shipping of the country. Should this contract be agreed upon the steamships of the Canadian-Australian Royal Mail Line will be manned at once and placed in operation again. Should the agreement be rejected the company is contemplating the removal of headquarters from New Zealand to London, or some other port, and abolishing Australian crews altogether. Several thousand people are stranded in Australia as a result of the strike.

It is reported that the Nippon Yusen Kaisha will shortly put into operation a new schedule that will link San Francisco as well as the Puget Sound and British Columbia ports in a passenger and freight service to the Orient. Unofficial advices are to the effect that sailings are contemplated on the following plan: The steamships placed in this service would come from Japan to Victoria, then to Seattle, back again to Victoria and from there to San Francisco, where the westbound passage would be commenced. Now that the

Nippon Yusek Kaisha has acquired the 15,000-ton German liner, Cap Finisterre, speculation is active as to whether it is the intention of the company to have this vessel operate in the new service. The Cap Finisterre is now in Yokohama and it is already announced that the company proposes to use her in the trans-Pacific routes. The steamship has accommodation for 1,500 passengers, is the largest merchant ship flying the Japanese flag, and would be an ideal boat for the service.

The Canadian Robert Dollar Company has purchased from the British Government the former German freighter Kurland. The deal was recently completed by President A. Melville Dollar, who is still in Great Britain. The Kurland was built in Germany during the war and was launched only last year. She has a displacement tonnage of 16,000 and will be added to the New York-Vancouver-Far East service recently inaugurated by the company.

A. B. Brostedt, general freight agent for the Canadian National Railways, left Victoria recently for an extended tour of the Far East, where he will make arrangements for cargoes to be carried by steamships of the Canadian Government Mercantile Marine, Ltd. It is expected that when Mr. Brostedt returns he will be able to make announcement of importance in connection with the Canadian lines' policy in respect to Oriental trade. It was announced some time ago that a working agreement had been entered into with the Blue Funnel Line, whereby vessels of the two companies will be operated jointly in the trans-Pacific service, giving through connections with the Canadian National Railways. According to General Manager R. B. Teakle, the Canadian operations across the Pacific have so far proved profitable. The monthly service to Australia will be continued, as well as the Indian service, and the Oriental sailings are to commence shortly. The boats in the Australasian service will be oil-burners. Four vessels will be used in each run.

MONTREAL NOTES

EVERY preparation is being made for an early opening of the navigation on the St. Lawrence. The Lachine canal has been emptied and is now undergoing its annual inspection preparatory to the reopening. It is not thought that many repairs will be required, but owing to the straining of some of the lock sills by the passage of extra large and heavily laden vessels last season, slight repairs will be needed to these lock gates and sills. Owing to the exceptionally mild weather that has prevailed this spring, the ice has disappeared fast both from the Upper Lakes and the river, and should there be a continued spell of such weather the passage from the Lakes to the sea will be open much earlier than in past years. The Lady Grey will commence operations at breaking up the ice between Three Rivers and Montreal and it is not thought that much difficulty will be experienced in this work, owing to the lightness of the ice at all points, the river being almost clear from Three Rivers down. As soon as the bulk of the ice is away the Department will commence the laying of the buoys between Montreal and Quebec. This work will only require about four or five days. The way things are shaping up at the present moment it looks as if the season will open about the first of April. If this is realized it will mean that shipping will start several weeks ahead of last year. Harbor authorities state that they are ready for the commencement, even should it be a month ahead.

The Marine Department at Ottawa announce the appointment of R. A. Wiallard, the local head of the Department of Marine and Fisheries, to the position of superintendent of pilots for Montreal and Quebec divisions. It is stated that Mr. Wiallard will carry on the duties of both offices, at least for a time, until it is seen how the plan works out.

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Officials of the Montreal Harbor Board have announced that every available foot of docking space in the harbor has been leased for the coming season. The two new sheds at Victoria Pier, which were finished last year, will add materially to the shed accommodation. Shed 19 is a two-story structure 900 feet in length, the floor loads being respectively 600 and 250 pounds per square foot. These two sheds will be leased by the Canada Steamships Lines.

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The Department of Naval Service are now operating the new direction-finding radio-telegraph station that has just recently been erected on the east side of the St. John harbor, about four miles from the city. This is the fourth station of its kind to be placed in commission on the Atlantic coast. It will act in conjunction with other finding stations, and in addition will serve the particular needs of the Bay of Fundy, enabling ships to navigate the bay safely in all weathers. This station will be known as the St. John station.

The Quebec harbor commissioners have been advised by the Dominion Government that a grant has been made for necessary improvements to the harbor at Quebec. This year's allowance will be the sum of $250,000, and it is expected that an equal amount will be granted each year until the proposed improvements are completed, the total cost of which is estimated to be approximately $1,000,000. One of the undertakings this year will be the construction of a large fixed tender to replace the floating ones now in use at the embankment near Beauport Flats. This change will enable the largest Atlantic liners to dock without difficulty.

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Another service will be added to that of the Canadian Government Merchant Marine this season, when the recently inaugurated freight and passenger service between Canada and the West Indies will be operated on a new basis, using Montreal instead of Halifax for the Canadian terminal of the service for the summer months. When this route was first established the schedule was planned on a three-weeks service, and it was thought that the boats would require to start from Halifax to keep within the specified time, but the addition of the Canadian Fisher and the Canadian Forester to the West Indies service makes it possible to increase the distance and make the terminal at Montreal.

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The shipping firm of Furness, Withy and Company have purchased the Fraser Building and site in Montreal and as soon as the present tenants vacate the offices in May, operations will be started at remodeling the premises for the Canadian head office. It is expected that the two first floors will be reserved for the shipping firm while the remainder of the building will be leased to other tenants. The new building will be known as the Furness House, the five stories giving a total floor space of 15,000 square feet. The location of the building is at the corner of St. Sacrament and St. Alexis streets. The company already have their own buildings at Halifax and St. John, and this one when remodelled will compare favorably with any of the other shipping firms.

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J. W. Norcross, president of the shipping consolidation, has just returned from England and it is expected that the annual meeting of the Canada Steamship Lines will be held before the close of March. The recent appointment of Mr. Norcross to the Foreign Commercial Commission, which has been formed to inquire into the rehabilitation of world trade, will not interfere with his duties as president of the steamship company. Mr. Norcross, while away, concluded arrangements with British and European marine and commercial interests, which will add to the activities of the Canada Steamship Lines. The business of this company has been developed largely in

the past through Great Lakes trade, so that the increased ocean traffic will enlarge the scope of the company's enterprise.

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The Clarke Steamship Company, with headquarters at Quebec, has been organized with a capital of $1,000,000. The company has been formed for the purpose of taking supplies and mails to and from the lower St. Lawrence and also for the purpose of developing the resources of the Gaspe district. The initial service will be started early in April and will be carried on by two 1,000-ton boats, but it is expected that this will be added to before the close of the season. One of the steamers will operate from Montreal, touching at points on the South shore, while that leaving from Quebec will cruise along the North shore as far as Harrington. These sailings will provide for a bi-weekly and ten-day service respectively. It is stated that one of the reasons for the formation of the company was due to the fact that they have received the contract for the carrying of mail to those points along the river where the vessels will touch. The primary objective, however, was the hope that considerable trade could be developed by increasing transportation facilities along the lower St. Lawrence.

News from Port of Sorel

BEAUCHEMIN & CO. are building, in the port of Sorel, a barge for the transportation of freight and passengers between Beloeil and Montreal. The owners of this barge are Mr. Gustave Guertin, of St. Charles, on the Richelieu river, and his son. This boat will be 175 feet long by 30 feet wide and 8 feet hold (depth) and will have 5-foot wings on each side. There will be satisfactory accommodation for passengers, such as staterooms and meal service on board, etc. She will be twin screw, propelled by two fore and aft compound engines, H.P. 13", L.P. 26", stroke 18". These engines and boilers were formerly in the barge "Prefontaine" owned by Mr. Guertin and dismantled by him some time ago. The boilers have a capacity of 130 pounds pressure. This vessel must be ready about July 1, 1921. The foreman of this construction is Mr. Louis Beaulac, the well-known shipbuilder formerly in the employ of the Transportation and Shipping, Ltd., who launched three large schooners for the latter company in 1920.

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The Transportation and Shipping have decided to change the trawlers begun by the Leclaire Shipbuilding Company during the war and which are now afloat by making tow boats out of them to be used as tugs in coasting. There is much work to do in connection with these changes. The boilers will have to be pushed forward, the decks will be lowered and a steel deck house will be built. The engines will be triple expansion 12¾" H.P., 21" I.P., 35" L.P., stroke 24". The boilers are Scotch marine type built for 180 pounds pressure. When in commission, these tugs will take 180 tons of coal in their bunkers.

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On the night of March 15, there was a lively scene along the shores of the Richelieu, when a fire broke out in the oil storage of the Transportation and Shipping shipyard. Flames were high and threw a clear light all along the water front. The building where the fire originated also contained the air compressor which served the whole shipyard and its destruction will delay operations there for some time. The next building contained the face plates and a smithy. Damages have not yet been ascertained at this date (17th).

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The Richelieu river is free from ice and the crossing to the Government yard at St. Joseph is made in tugs provided by the Government until the ferry is put into commission.

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S.S. Oceanica, an American barge bought by Lachance Limitee, of Quebec, is at Sorel, and her engines and boilers will be taken out. Her boilers are two Scotch marine 12 feet 6 inches in diameter, three furnaces each.

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The Sincennes-McNaughton Line have several tugs under steam ready for work.

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The C.S.L. steamers "Quebec," "Saguenay" and "Cape Diamond" are being prepared for the season 1921.

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Mr. Alfred Beauchemin, president of the Chambre de Commerce, Sorel, president of the Beauchemin Foundries, Steel Works, etc., is recovering from a fall which he suffered recently, spraining his ankle.

PECULIAR ATMOSPHERIC OCCURRENCES

The following interesting account of waterspouts encountered in the English Channel was furnished by Second Officer E. S. Davies, of the British steamer British Marquis:

"On the afternoon of Dec. 12, 1920, during passage up the English Channel, when between Start Point and the Bill of Portland, we had the pleasure of witnessing at close quarters an atmospheric disturbance, common enough perhaps in some latitudes, but something of a rarity in that locality.

"From noon that day the wind had been blowing from northeast, accompanied by heavy nowstorms and fog, but about 3 o'clock the weather took a decided turn for the better, clearing rapidly, the snow recurring at only long intervals and the fog dispersing.

"Contrary to what might have been expected, the dense nimbus clouds were not immediately driven to leeward, but seemed to be forcibly rolled back from the southeast, the sky clearing from that direction first, the line of demarcation between clouds and blue sky eventually resolving itself above our heads in an east and west direction.

"We were then (about half past 3) in a position with the sky above the northern semicircle of our horizon densely packed with nimbus clouds, the southern one sparsely dotted with fracto-cumulus, wind continuing approximately northeast, but very erratic, and the edge of the cloud bank above our heads low and violently distorted.

"The water surface along our track became agitated in several places, and in a few minutes a number of waterspouts were forming, dispersing, and reforming under the edge of the cloud bank, moving the while rapidly to the west.

"We took pains to avoid them, but a new one, springing into existence directly ahead of the vessel, caught us before we were able to make a detour, fortunately without harmful result—a momentary descent of wet, screaming winds and it was past. Thus learning their light and fragile character, we were encouraged in examining them at close quarters, and were struck by their many remarkable features. At first the sea appeared to be in a state of violent ebullition, then from the low-lying clouds descended rapidly swirling inverted cones of vapor, which united with the disturbance below to form what can only be regarded as miniature cyclones, the water surface being continuously lashed into a foam which ascended to the clouds in trunks of the usual spiral form, the motion of the spiral being noticeably contraclockwise in each case. The trunks were of considerable beauty and could well be compared with the stem of an old wineglass with its delicate spiral tracery, the most noticeable feature, however, being their cores or axes. These latter were in diameter about one-sixth that of the spouts themselves and were entirely devoid of vapor, thus forming inner tubes bounded by continuous spirals of vapor of varying shades, dark about the periphery of the cores and gradually becoming lighter toward the outer boundaries. Although normally they rose vertically from the surface of the sea, yet in their lateral progress the vagaries of the wind caused them to assume many and curious posi-

tions, sometimes inclining them to angles of large dimensions, sometimes contorting them into snakelike forms, and sometimes so violent as to destroy the continuity of the forces controlling them, causing them to break and disperse.

"By 6 o'clock the wind had shifted to the southeast and the sky quite clear. "At a conservative estimate we saw twenty waterspouts that afternoon, all lying in our track, and it is a remarkable fact that a companion vessel proceeding in the same direction, but distant about two miles north of our vessel, and consequently well under the cloud bank, did not encounter a single one."

Report on Air Ministry Competitions

THESE competitions were held during August and September last, with the object of ascertaining the best types of aeroplanes and amphibians which would be safe, comfortable and economical for air travel, and, in the case of the amphibians, capable of alighting on and rising from the water as well as land. Details as regards the rules of the competitions, the entries received, the actual competitors and the prizes awarded have already been published, and competitors have already received a technical report of the judges' committee.

The broad general conclusions of that committee are summarized below.

One effect of the rules of the competitions was to encourage the production of aircraft having an ample reserve of power. To obtain this reserve without sacrificing economy or useful load entails the use of an engine of high power for its weight, but normally run well below its maximum power. The advantage thus attained in regard to safety is clearly shown in the greatly increased ability to arise out of a confined space, while the reduced normal strain on the engine largely assists in producing a reliable machine.

In spite of the higher first cost of such an aircraft it is almost certainly a better commercial proposition than a machine with the same normal performance and little or no reserve of power.

As regards landing in a confined space, the pilot's view and the controllability of the machine are two very important factors, and there is some tendency to place upon them insufficient weight.

The run on the ground after such landings can be reduced if suitable wheel brakes are fitted, and very promising designs were exhibited by some competitors.

The precautions taken by designers to avoid any risk of fire in the air and largely to reduce the risk of fire in the event of a crash showed that this important point had received due attention, and ideas embodied in competing machines will be of definite value in future designs.

The amphibians also displayed a marked advance towards safety in another direction. Capable of alighting on and rising from any practicable site on land or water, they have a great advantage over other forms of heavier-than-air craft, while the low position of the hull very largely reduces any risk of injury in the event of a minor accident on the ground.

This type of aircraft has a high potential value for commercial purposes as its use will in many cases very much shorten the distance to be flown and also enable passengers to be landed on a river in the heart of a city instead of on an aerodrome some considerable distance outside.

In regard to the twin-engined machines, further information was gained as to the conditions determining their ability to fly on one engine, and it was clearly shown that, given adequate attention to certain details of design, a twin-engined machine can fly on one engine, thereby increasing its reliability and safety.

Aircraft designed for commercial use show a marked advance in comfort over those originally designed for war purposes and afterwards modified to suit civil requirements. Seating accommodation, heating and ventilation arrangements have reached a very fair standard of comfort, but in this respect the question of silencing the engines has not yet had sufficient attention. The design of aircraft as affecting their economical use is of great importance commercially, and in this respect the competitions brought forward many excellent points in detail design.

The reduction in the number of parts subject to wear, and the increased accessibility of those requiring attention was attained in competing machines to such an extent as to offer a considerable improvement in economy of maintenance.

The rules of the competitions permitted the use of secondary equipment of foreign manufacture.

It is satisfactory to note, however, that the items of foreign equipment utilized by competitors were insignificant in number and practically confined to petrol gauges, in which connection it was remarked that no really suitable gauge showing the quantity of petrol in the tank was fitted on any competing machine.

The magnetos fitted were all of British design and construction. While there is little doubt but that when a few mechanical details have been improved the British magneto will be the best in the world, the results of the competitions show that the British magneto manufacturers are now abreast of any of their foreign rivals.

Extract from The Times, Wednesday, 9th February, 1921

The Air Ministry began a series of trial flights yesterday from Brooklands Aerodrome to Westminster, with the object of ascertaining the practicability of establishing a station for amphibious aeroplanes on the Thames, in the heart of London. The flights are being carried out by Messrs. Vickers, Limited, on behalf of the Ministry. For the demonstration yesterday a Vickers "Viking" amphibian was used, fitted with a 450-horse-power Napier "Lion" engine. The pilots were Mr. Cockerell and Mr. Broome, who had charge of the Vickers-Vimy-Commercial-Rolls machine in the attempt organized by the Times to fly from Cairo to the Cape.

The trial yesterday was entirely successful. The amphibian took off from the aerodrome at Brooklands at 2.46 p.m., arrived at Westminster at 3 o'clock, circled the Houses of Parliament, and after making towards Blackfriars turned and alighted on the water opposite the Terrace of the House of Commons. One or two short flights were made over the river to demonstrate the rapidity with which the machine can rise from water—the average time taken was 9 seconds—and the "Viking" then returned to Brooklands.

The pilots were allowed to start and alight in their own time. In the next trial they will be required to fly to a time-table drawn up by the Air Ministry The machine bore yesterday a load of ballast equivalent to the commercial load she has been designed to carry. The weather was bad for flying, there being practically no wind and much fog.

Preventing Delay

Air-borne goods for a great city are delayed in delivery because the terminals of air routes can rarely be in, or even comparatively near, the city itself. The time gained in the air is thus lost through the last stage of the journey being made with ground transport. The object of the present test flight is to overcome this difficulty. The amphibious machine is the obvious instrument with which to do it. The "Viking," being fitted with a retractable under-carriage, can alight on and rise from land or water with equal ease. Thus goods or mails carried in such craft can be brought direct to London or any other city built on a river bank or the coast of lake or sea.

The "Viking" has accommodation for five persons, and can be adapted to give 76 cubic feet of cargo space. She will carry 1,070 pounds weight of goods. The details of her measurements and performance are:

Overall length, 33 feet 6 inches.

Overall height (on wheels), 15 feet 1 inch.

Span, 46 feet.

The "Viking" won the first prize of £10,000 for the amphibian class in the Air Ministry Aircraft Competition last September.

American Society of Safety Engineers

"SAFETY to Life in Ship Construction and Operation" was the subject of four interesting papers read on Friday night at the meeting of the American Society of Safety Engineers at the Engineering Societies Building in West 39th street, New York. Among the speakers were Captain R. A. Barber, Marine Surveyor and formerly first officer of the S.S. Lusitania, whose subject was "Safety to Life in Ship Operation;" F. S. Titsworth on "Some Statistics with Reference to the Marine Fire Hazard;" Thomas A. Walsh on "Accident Prevention Work in Shipbuilding," and S. Clarke Brandenstein on "Safety to Life in Ship Construction."

"The safety of a vessel broadly depends on seaworthiness, stability, navigation, seamanship and equipment," said Captain Barber, who gave many interesting details regarding present day improvements in construction and operation and advocated that safety first be applied to shipping and that all desires to make speedy voyages through fog and ice regions be sidetracked. The unsinkable ship has not yet shown up, he said, although by means of innumerable honeycombing bulkheads, only feasible in ships of war, an almost perfect floating machine can be constructed. "The means of securing hatches are still primitive, and the safety of vessel and crew often depend on but two and one-half inches of wooden hatch cover insecurely secured at best.

"The lifebelt has not been materially improved upon for many years but can at best be considered of secondary importance in ocean going vessels. In wintry weather they have little value, and practically all of those picked up are found to be frozen to death.

"Lifeboats and their launching appliances still maintain the premier position in life-saving needs and have ever occupied much attention in the deliberations of those chosen to frame regulations for preservation of life at sea.

"The perfect lifeboat must be, comparatively speaking, unbreakable, unsinkable, capacious, and easy of propulsion. It must be capable of being easily secured for carriage at sea, yet readily cleared away, disengaged and lowered into the water without injury to itself or its occupants.

"It must be available for lowering when the vessel is disabled and rolling or pitching in a seaway and also when the ship has taken a list.

"It ought to be fireproof.

"It is a very difficult problem to provide befitting accommodation on board on the upper deck of a large passenger ship for sufficient boats for all people carried, hence we find the unsatisfactory substitutes such as liferafts and collapsible boats.

"Whereas mechanical hoisting and lowering apparatus has been devised, if the liferaft is carried underneath the lifeboat, the problem of winding up the long tackle to lower the raft exists, and if this work has to be performed by night or in heavy weather one can readily imagine the consequence, more especially when the ship is heeled over.

"There are many excellent davit devices for speedy lowering and recently an inventor, J. L. Hyland, has perfected a very simple device, consisting of a pair of curved skids or runners, kept clamped to the inboard side of the lifeboat, which not only prevents the boat from being stove in, but insures the act of lowering against even a heavy list, by permitting the boat to slide down the shell plating, over any openings or projections, and also prevents the boat from heeling over during the act of lowering. It can be slipped after the boat has gotten well clear of the ship in the water, or retained on the lifeboat to protect it when it is being picked up by another ship.

"A visit to any cargo steamer in the harbor will prove the lack of safety devices. The guards about ladders, gangways and hatches are seldom other than primitive even in the highest class of vessels, the rope lashing being considered sufficient in most cases. Portholes are seldom barred and should be large enough to permit the escape of human beings, but removable bars would mean safety for life and would prevent thefts from outside."

Mr. F. S. Titsworth said that in the past ten years the cost of sea disasters amounted to $171,216,278, over twenty millions of which was from fire, and 85 per cent. of such fires were in the hulls of the ships. He strongly advocated the adoption of adequate apparatus for the quick discovery of fires in cargo or bunker, saying that the fire fighting devices were adequate but that little means is now taken to discover the fires at inception in the holds of freight steamers, with the result that the fire gains great headway before the man-handled apparatus is brought into play.

MAKING BOILERS SAFE

To operate boilers, and especially water-tube boilers, with safety it is necessary to prevent the water becoming too dense on account of the salts dissolved in it. A continuous means of measuring the density of the water is therefore most important, and it is supplied by a simple "densimeter" invented and manufactured by a British firm. In this appliance a column of distilled water is balanced against a column of water from the boiler, and the difference in the levels of the two columns is a measure of the density of the boiler water. A scale is provided by which the precise difference in levels can be easily read, thus giving the engineer in charge a ready warning when the danger point is being reached. This apparatus has received the approval of the boiler insurance companies.

BRITISH AIR SERVICE RECORDS

Civil aviation in Great Britain opened in May, 1919, and from that time up to the end of last year British aircraft flew considerably more than a million and a half miles. The number of flights was over 62,000 and close on 110,000 passengers were carried. Goods to a total weight of 167 tons were transported, mostly in Continental services.

The figures for each quarter show a marked increase in both passenger and goods traffic. The safety of the air service is indicated by the fact that the rate of passengers killed per ten thousand carried was only one.

THE PANAMA CANAL

Memorandum for all Concerned

The following self-explanatory cablegram from the Acting Governor of the Panama Canal, Balboa Heights, Canal Zone, dated March 3rd, is quoted for the information and guidance of all concerned:

"Price of fuel oil reduced to $2.75 per barrel at each end of the Canal effective March 10th, 1921."

A. L. Flint, Chief of Office.

A NOVEL ENGINE ROOM TELEGRAPH

One of the most novel and interesting devices shown at a recent exhibition of scientific appliances in London was an electrical instrument for measuring and controlling the speed of machinery. As applied on board ship it enables the captain to indicate to the engineer exactly the speed at which he wishes the engine to run, ahead or astern. Similarly, the captain can ascertain at any moment the speed at which the engines are running. This appliance can be used in a factory to indicate to the works manager in his office the speed at which any machine, no matter at what distance, is operating. The instrument is exceedingly simple and equally sensitive.

New York.—A general reduction in the wages of all employees on ferries, tugs, lighters, barges, etc., in and around the harbour of New York, ranging from 15 per cent. to 23 per cent. will be put in force shortly. The probable date will be about the middle of April or May 1st. There will be about 15,000 men affected and the effect of the reductions will be to entirely wipe out the increases granted last year by the United States Labor War Board.

Marine News From Every Source

Ottawa.—The Wallace Shipbuilding and Dry Dock Company Ltd., has contracted to finish the two vessels building for the Government at Prince Rupert, which are of 8,390 tons each, for the cost of labor and material plus a profit of 8 per cent.

Goderich.—Mr. W. L. Sanderson, formerly with the Sturtevant Company at Galt and previous to that with Messrs. Goldie & McCulloch of the same city, has been appointed general manager of the National Shipbuilding Co., Goderich, taking up his duties at once.

Cleveland.—A deal was put through here recently which involved the Columbian Steamship Company taking over the fleet of W. C. Richardson, which comprised eleven steel steamers. Crispin Ogleby is president of the Columbian Steamship Company and John T. Kelly will be fleet manager.

New York.—The largest ship in the world, the "Bismarck," now renamed the "Majestic" has been handed over to Great Britain by the Reparations Committee. She is 56,000 tons gross, about five times the size of the old White Star Line "Majestic" and is about 1,800 tons larger than the Leviathan.

St. Thomas.—One of the old lake sailors died here recently at the advanced age of 70 years. He was Captain Joseph Hough, one of the best known residents of Port Stanley, and had commanded vessels on Lake Erie for over forty years. He leaves a son, five brothers, and six sisters, all residents of this district.

Detroit.—Weather forecasts from the United States Weather Bureau will in future be made to vessels on the lakes by means of the radiophone, instead of telegraph and wireless. The new method will lead to greater safety on the lakes, as vessel masters can get warning in ample time to allow them to make shelter.

Montreal.—Feeling that trade will be better on the Great Lakes than on the deep sea this year, the Canada Steamship Lines will recall five if its ocean going vessels to the lake routes. The vessels in question, which went into the salt water trade due to the exigencies of war, the the "Glenellah," "Edmonton," "Beaverton," "Kenora" and "Canadian." They will run from Port Arthur and Fort William, to Montreal, calling at Toronto and Hamilton and intermediate points.

Mackinaw City.—The Standard Oil steamer "Renown" has again started her season's work, passing down through the Straits on March 27th. The "Renown" was also the first steamer to pass through the Straits last season. The ice has pretty nearly all gone although there are a few scattered ice fields still passing through.

Toronto.—Navigation is expected to open here about the first or second day of April, and it is confidently expected that the "Macassar" will again have the privilege of making the first trip in to the harbor, thus enabling the skipper to win a hat from the Harbor Master. Last year the Macassa made the trip arriving here on the 29th March.

New York.—The retirement is announced of Captain William M. Smith, the port captain of the White Star Line in New York. The captain is a native of Halifax, N.S., and has had a service of 43 years with the company. He went to sea first in 1868, serving his apprenticeship in the East Indian and Cape Horn trade.

Toronto.—According to the harbourmaster the level of the water in the harbor this year is ten inches above that of last year at the same time, and that the level this summer would be fully a foot higher than last summer. The harbor master also announced that the licenses for the small craft had now arrived and were ready for distribution.

Washington.—The U. S. Shipping Board's operations were costing the taxpayer of the U.S. the sum of $750,000 per day according to Senator Edge in the Senate the other day. Thirty-three per cent. of the Board's vessels were tied up. If all charges are met an appropriation of $395,245,000 will be required for this year. The Walsh report recommended the management of the Government fleet by one executive instead of seven as at present.

Owen Sound.—The contractor for the new dock on the east side of the harbor has got his gangs at work in preparation for building the new concrete pier. The preliminary work consists of pulling out the piles of the old wharf, which is being done at the rate of about eight piles per day. The new piles for the substructure of the concrete wharf are on the site, all ready to be driven when the old ones are out.

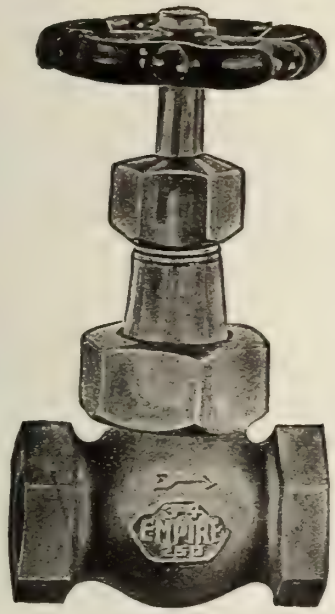
Cleveland.—Reports from Cleveland show no particular activity in early cargo charters, and a slow start is expected. In all lines except grain the demand is light at both ends of the route. There are heavy stocks of grain at Chicago and at the Canadian head of lakes, but it is expected that the bulk of the grain at Port Arthur and Fort William will be carried by Canadian vessels.

London.—The Admiralty have at last consented to hear the claim of Lieut Henry Bell Irving, of Vancouver, who with another officer made a salvage of a steamer on the Goodwin Sands. The value of the vessel and cargo was 120,000 pounds, or about $600,000. The Admiralty allowed the claim of salvage originally, but later withdrew their assent. They have now consented to consider the right of the two officers to claim salvage.

Buffalo.—The death occurred here recently of Thomas W. Jackson at the age of 62. The deceased was born in Toronto and was a son of Capt. Henry Jackson. The latter gentleman held the distinction of having sailed a large vessel to Hamburg with cargo of timber. Mr. Jackson was both engineer and captain, holding papers for both ranks. He came to Buffalo in 1897 and was chief engineer of the North Wind up to his retirement three years ago. He is survived by a widow and two sons. The deceased gentleman was a Mason, and a member of the N.A.S.E. and also the Marine Engineer's Beneficial Association.

London.—The captain of the "Aquitania," Sir James Charles, K.B.E., C.B., R.D. and R.N.R., has been officially appointed as commodore of the Cunard Line, which is about the highest distinction that can be attained by a sea going member of the staff. Captain Charles has had a long and honorable career in the company's service, and received several honors during the war for his services. Like most of the captains in the large British liners he served his apprenticeship in the sailing vessel, going to sea at the age of 15. He joined the Cunard Line in 1895, and has commanded the Lusitania, Mauretania, Carmania, Saxonia and Aquitania, besides some of the smaller ships of the line.

Works at High Pressure



A-846

This EMPIRE re-grinding valve is designed for use in connection with high-pressure steam and marine work. It is made of high-grade steam metal and is factory tested and fully guaranteed for working pressures up to 250 pounds.

It is doubly serviceable because the seat can easily be reground from time to time.

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NOTICE TO MARINERS

NOVA SCOTIA

(2) Cape Breton Island—Sydney Harbor —Dredging

During the past season the Department of Public Works of Canada has dredged the berths at McKinnon's wharf and Ingraham's wharf, Sydney harbor, as follows:

McKinnon's Wharf—

On the north and south sides of the wharf the berths have been dredged to a depth of 16 feet from the outer corner of the wharf, shoreward for a distance of 150 feet and a width of 40 feet.

Ingraham's Wharf—

On the north side of Ingraham's wharf the berth in front of the coal shed, 95 feet wide with an average length of 60 feet, was dredged to a least depth of 15 feet.

N. to M. No. 1 (2) 22-1-21.

Authority.—Report from Department of Public Works, Ottawa.

Canadian Naval Charts.—No. 415.

Admiralty Charts.—Nos. 2042, 2687 and 2727.

Publication.—St. Lawrence Pilot, Vol. 1, 1916, page 46.

Departmental File.—No. 51540.

* * *

NEW BRUNSWICK

(3) Chaleur Bay—Petit Rocher—Change in Position of Light

Date.—Without further notice.

New Position—The light will be moved to a new position at bend in breakwater, 185 feet from its former position on end of breakwater.

Mariners are warned that the light not being on the end of the breakwater, they must give it sufficient berth to clear the breakwater when entering the harbor.

N. to M. No. 1 (3) 22-1-21.

Authority.—Departmental records.

Admiralty Charts.—Nos. 1715 and 2516.

Publication.—St. Lawrence Pilot, Vol. 2, 1916, page 308.

Canadian List of Lights and Fog Signals, 1920.—No. 935.

Departmental File.—No. 20935R.

* * *

QUEBEC

(4) Saguenay River—Grosse Roche—Character of Light to Be Changed

Date.—On opening of navigation, 1921.

Position.—On east side of river, about one mile above Grosse Roche, Latitude N. 48° 14′ 2″ Longitude W. 69° 53′ 24″.

Change in Light.—The 6th order dioptic fixed white light will be replaced by an occulting white acetylene gas light, shown from a lens lantern.

Remarks—The light will be unwatched.

N. to M. No. 1 (4) 22-1-21.

Authority.—Report from Agent, Department of Marine, Quebec.

Admiralty Charts—Nos. 1370 and 2516.

Publication.—St. Lawrence Pilot, below Quebec, 1916, page 58.

Canadian List of Lights and Fog Signals, 1920.—No. 1114.

Departmental File.—No. 21114A.

E. HAWKEN,
Acting Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, January 22, 1921.

* * *

No. 2 of 1921
(Pacific No. 1)

BRITISH COLUMBIA

(5) Vancouver Island—Alberni Canal—Franklin River—Light Established on Beacon

Position.—At First narrows, on edge of shoal off mouth of Franklin river.

Latitude N. 49° 6″ 10″ Longitude W. 124° 49′ 10″.

Character.—Occulting white acetylene gas light shown from a lens lantern.

Elevation.—Twelve feet.

Description.—Five pile dolphin surmounted by a white wooden circular daymark and lantern.

N. to M. No. 2 (5) 24-1-21.

Authority.—Report from Agent, Department of Marine, Victoria.

Admiralty Charts.—Nos. 584, 1911 and 1917.

Publication.—British Columbia Pilot, Vol. 1, 1913, page 487.

Canadian List of Lights and Fog Signals, 1920.—To be inserted as No. 2262.6.

Departmental File.—No. 22262.6C.

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BRITISH COLUMBIA

(6) Vancouver Island—Victoria Harbor —Channel Closed Temporarily

During the construction of piers for the new Johnson street bridge, Victoria harbor, the eastern channel through the present bridge will be closed to navigation.

N. to M. No. 2 (6) 24-1-21.

Authority.—Report from Agent, Department of Marine, Victoria.

Admiralty Charts.—Nos. 1897b, 576, 2689, 1911 and 1917.

Publication.—British Columbia Pilot, Vol. 1, 1913, page 64.

Departmental File.—No. 51511.

* * *

BRITISH COLUMBIA

(7) Juan de Fuca Strait—Swiftsure Bank Light Vessel—Radiotelegraph Station Established

Information has been received from the District Communication Superintendent at the Navy Yard, Puget Sound, via the Branch Hydrographic Office at Seattle, that a radio station has been established on Swiftsure Bank Light Vessel and is now in operation.

Watches will be maintained in accordance with the Communications Regulations and the operator will listen in for five minutes at the beginning of each hour from 8 a.m. to 9 p.m., inclusive.

This station will be able to handle traffic on wave lengths of 300, 378, 476, 60, 756, and 952 meters.

Personal and commercial messages will not be handled.

Local weather forecasts will be broadcasted on 600 and 952 meters at 8 a.m., 12 noon, 4 p.m., and 8 p.m., daily.

Approx. position: 48° 31″ 50″ N., 125° 00 00″ W.

N. to M. No. 2 (7) 24-1-21.

Authority.—U. S. Hydrographic Office N. to M. No. 2 of 1921.

Canadian List of Lights and Fog Signals, 1920.—No. 2264.5.

E. HAWKEN,
Acting Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, January 24, 1921.

Pilots, masters or others interested are earnestly requested to send information of dangers, changes in aids to navigation, notice of new shoals or channels, errors in publications, or other any facts affecting the navigation of Canadian waters to the Chief Engineer, Department of Marine and Fisheries, Ottawa, Canada. Such communications can be mailed free of Canadian postage.

* * *

ADMIRALTY PUBLICATIONS

(10) Information with regard to True Bearings

The following information has been published by the British Admiralty.

Notice is given that on and after 1st January, 1921, the following procedure with regard to True bearings will be gradually introduced into all Admiralty charts and other Admiralty Hydrographic publications:

(1) The method of giving True bearings in the three-figure notation will be adopted, thus:

Example: 6° will be indicated thus 006°. 45° will be indicated thus 045°. And 123° will be indicated thus 123°, etc.

Time does not permit of the foregoing system being embodied in the Admiralty List of Lights for 1921, but subsequent corrections to this list, published in Section VIII of the weekly edition of Admiralty Notices to Mariners will be in accordance with the new system outlined above. This system will also be adopted shortly for Supplements to those volumes of Sailing Directions in which the bearings are given True.

(2) With the adoption of the above system, the following change in expression will also be made in compiling or revising Sailing Directions:

In such an expression as "In approaching the entrance of the harbor the lighthouse should be kept **northward**" of a certain bearing, the terms **"more than"** or **"less than"** will be used in conjunction with a bearing instead of **"northward," "southward," "eastward,"** or **"westward."**

The term **"more than"** will refer to a

bearing in a clockwise direction from the stated bearing and the term "less than" to a bearing in an anti-clockwise direction from the stated bearing.

Thus: more than 045° means a bearing of 046° or more, less than 045° means a bearing of 044° or less, more than 001° means a bearing of 002° or more, less than 001° means a bearing of 000° or 359° or less, more than 000° means a bearing of 001° or more, and finally in the special case of "less than 000°," the expression "less than 360°" will be adopted, meaning a bearing of 359° or less.

Authority—Admiralty Notice to Mariners No. 2066 of 1920.

Departmental File—No. 17529.

E. HAWKEN,
Acting Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, February 11, 1921.

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NOVA SCOTIA

(11) South coast — Halifax harbor entrance—Sambro Outer bank—Lightship replaced on her station

Former Notices—Nos. 58 (143), 66 (165) and 91 (224) of 1920.

Position—6 1-5 miles 156° (S. 2° E. mag.) from Sambro island lighthouse.

Latitude N. 44° 20′ 30″.

Longitude W. 63° 30′ 20″.

Lightship Replaced—Lightship No. 15 has been replaced on her station and will be maintained thereon until on or about June 1st, when she will resume her station off Heath point, Anticosti.

N. to M. No. 4 (11) 14-2-21.

Variations in 1921—23° W.

Authority—Memo. from Commissioner of Lights.

Admiralty Charts—Nos. 2410, 1651, 729, 1666, and 2670.

Publication—Nova Scotia Pilot, 1911, page 141.

Canadian List of Lights and Fog Signals, 1920—No. 322.

Departmental File—No. 21040 M.

* * *

QUEBEC

(12) Gulf of St. Lawrence—Ste. Anne des Monts—Change in character of buoy

Date—On opening of navigation, 1921.

Position—On edge of shoal, about 600 feet off the wharf at the mouth of Ste. Anne des Monts river.

Change in buoy—The black steel can buoy will be replaced by a red wooden spar buoy.

Remarks—Buoy is subject to change in position owing to the shifting of the shoal.

N. to M. No. 4 (12) 14-2-21.

Authority—Report from Superintendent of Lights, Quebec.

Admiralty charts—Nos. 307 and 2516.

Publication—St. Lawrence Pilot, Vol. 1, 1916, page 107.

Departmental File—No. 11754.

E. HAWKEN,
Acting Deputy Minister.

Department of Marine and Fisheries.
Ottawa, Canada, 14th February, 1921.

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NEW BRUNSWICK

(8) Bay of Fundy—Quaco ledge—Character of buoy to be changed.

Date—On opening of navigation, 1921.

Position—In 10 fathoms, 1-8 mile 295 (N. 44° W. mag.) from the ledge.

Latitude N. 45° 14′ 35″.

Longitude W. 65° 22′ 40″.

Change in character—The gas and whistling buoy will be replaced by a gas and bell buoy.

Remarks—Bell rung by the motion of the buoy on the waves.

N. to M. No. 3 (8) 11-2-21.

Variations in 1921—21° W.

Authority—Departmental records.

Admiralty Charts—Nos. 353, 352, 1651 and 2670.

Publication—Nova Scotia and Bay of Fundy Pilot, 1911, page 318.

Canadian List of Lights and Fog Signals, 1920—No. 117.

Departmental File—No. 20117.

* * *

NOVA SCOTIA

(9) West Coast — Pubnico gas and whistle buoy to be changed in position and characteristic—St. Johns ledge buoy to be re-established.

Date—On or about 1st of April, 1921.

New position of gas buoy—On former position, in 16 fathoms, 6 miles 218° (S. 57° 30′ W. mag.) from Pubnico lighthouse.

Latitude N. 43° 31′ 6″.

Longitude W. 65° 52′ 5″.

Character—Occulting white light.

Color—Black and white vertical stripes.

St. Johns ledge buoy re-established.

Position—On former position, southwestward of the ledge.

Latitude N. 43° 30′ 22″.

Longitude W. 65° 48′ 49″.

Description—Red steel conical buoy.

N. to M. No. 3 (9) 11-2-21.

Variations in 1921—19° 30″ W.

Authority—Departmental records.

Admiralty Charts—Nos. 399, 352, 1651 and 2670.

Publication—Nova Scotia Pilot, 1911, page 220.

Canadian List of Lights and Fog Signals, 1920—No. 229.

Departmental File—No. 19589.

* * *

NOVA SCOTIA

(20) North coast—Pictou harbor—Dredging

During the past season the Department of Public Works of Canada has dredged the berths at Burnham and Morrill's wharf and at the Canadian National Railway Company's east wharf, as follows:

Burnham and Morrill's Wharf

On the west side of the wharf an area 120 feet long by 80 feet wide was dredged to a least depth of 10 feet.

Canadian National Railway Company's Wharf

On the west side of the east wharf an area 75 feet wide was dredged from a point 40 feet inside the outer end of the wharf, shoreward for a distance of 350 feet, to a least depth of 25 feet. The east side of the dredged area is 15 feet west of the wharf.

N. to M. No. 7 (20) 22-2-21.

Authority—Report from Department of Public Works, Ottawa.

Admiralty Charts—Nos. 1980, 2034 and 1651.

Publication—St. Lawrence Pilot, Vol. 2, 1916, page 154.

Departmental File—No. 37432.

E. HAWKEN,
Acting Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 22nd February, 1921.

* * *

NOVA SCOTIA

(18) Bay of Fundy—Cumberland basin—Amherst basin range lights to be discontinued.

Position of front light.—Near west corner of basin.

Latitude N. 45° 50′ 4″.

Longitude W. 64° 16′ 40″.

Lights discontinued—The range lights will be discontinued without further notice.

N. to M. No. 7 (188) 22-2-21.

Authority—Departmental records.

Admiralty Charts—Nos. 354, 353, 2034, 2516 and 1651.

Publication—Nova Scotia and Bay of Fundy Pilot, 1911, page 328.

Canadian List of Lights and Fog Signals, 1920—No. 131 and 132.

Departmental File—No. 20131-2R.

* * *

NOVA SCOTIA

(19) Cape Breton Island—Sydney harbor—Southeast bar—Fog bell to be discontinued.

Position—At lighthouse, on west extremity of Southeast bar.

Latitude N. 46° 12′ 23″.

Longitude W. 60° 13′ 12″.

Fog bell to be discontinued — On or about 1st April, 1921, the fog bell will be discontinued.

N. to M. No. 7 (19) 22-2-21.

Authority—Departmental records.

Canadian Naval Charts—Nos. 415.

Admiralty Charts—2042, 2687, 2727 and 1651.

Publication—St. Lawrence Pilot, Vol. 2, 1916, page 42.

Canadian List of Lights and Fog Signals, 1920—No. 472.

Departmental File—No. 20472F.

BRITISH COLUMBIA

(16) Malaspina strait—Texada island—Off Grilse point—Cyril rock—Elevation of light.

Former notice—No. 76 (185) of 1920.

Position—On the rock.
Latitude N. 49° 48′ 23″.
Longitude W. 124° 35′ 59″.
Elevation—15 feet.
N. to M. No. 6 (16) 18-2-21.

Authority—Report from agent, Department of Marine, Victoria.

Admiralty Charts—Nos. 585, 580 and 1917.

Publication—British Columbia Pilot, Vol. 1, 1913, page 352.

Canadian List of Lights and Fog Signals, 1920—No. 2329.4.

Departmental File—No. 22329.40.

* * *

BRITISH COLUMBIA

(17) Seaforth channel—Dall patch—Change in position of gas and whistle buoy—Conical buoy to be established.

Date—Without further notice.

New position of gas and whistle buoy—Off north extreme of patch, outside of wreck of barge "Drummond."

Latitude N. 52° 13′ 9″.
Longitude W. 128° 11′ 00″.
Color—Black.

Position of conical buoy—On position formerly occupied by gas and whistle buoy.

Latitude N. 52° 12′ 57″.
Longitude W. 128° 10′ 54″.
Color—Red.

Note—This buoy will no longer be considered as a fairway buoy.

N. to M. No. 6 (17) 18-2-21.

Authority—Departmental records.

Admiralty Charts—Nos. 2449 and 1923b.

Publication—British Columbia Pilot, Vol. 2, 1913, page 45.

Canadian List of Lights and Fog Signals, 1920—No. 2359.

Departmental File—No. 37391.

E. HAWKEN,
Acting Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 18th February, 1921.

* * *

ONTARIO

(13) Lake Ontario—Oakville—Dredging.

The Department of Public Works of Canada has dredged the channel at the entrance to and inside the piers at Oakville, to a depth of 14 feet below the zero of the gauge, which is 245 feet above M.S.L., New York, as follows:

The east extreme of the dredged channel begins at a point 2,700 feet 132° (S. 41° 30′ E. mag.) from the southwest corner of the east pier, the channel being 100 feet wide, gradually narrowing to a width of 50 feet at a point nearly opposite and 25 feet from the lighthouse on the east pier. Between the piers the dredged channel is 50 feet wide, the east side of the channel being parallel to and 25 feet from the east pier. From the inside end of the piers the channel is 50 feet wide and 600 feet long, extending in a northerly direction to the mouth of Oakville creek.

N. to M. No. 5 (13) 14-2-21.

Variation in 1921—6° 30′ W.

Authority—Report from Department of Public Works, Ottawa.

Canadian Naval Charts—Nos. 73 and 63.

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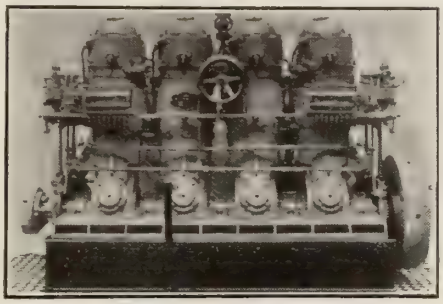

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Publication—U. S. Lake Survey Bulletin, No. 29, page 415.

Departmental File—No. 51534.

* * *

ONTARIO

(14) Lake Erie—Port Maitland—New back range light established—Fog bell established.

Position of back range light—At angle of the west pier, 900 feet 23° (N. 29° E. mag.) from front light.

Character—Fixed white electric light shown from a reflector lantern.

Elevation—75 feet.

Description — Square steel skeleton tower surmounted by a small lantern.

Position of fog bell—On balcony of front range lighthouse.

Description—Fog bell, operated by electricity, rings continuously during excessively thick weather.

N. to M. No. 5 (14) 14-2-21.

Variation in 1921—6° W.

Authority—Departmental records.

Canadian Naval Chart—No. 74.

Publication—U. S. Lake Survey Bulletin No. 29, page 385.

Canadian List of Lights and Fog Signals, 1920—No. 1844.5.

Departmental File—Nos. 21844F and 21844.5C.

* * *

ONTARIO

(15) St. Mary's River—Sault Ste. Marie —Dredging

As a result of dredging operations carried on by the Department of Public Works of Canada in 1919 and 1920, the Canadian side of the St. Mary's river in front of Sault Ste. Marie, south of a line connecting the outer ends of the wharves, from the Algoma Central Railway coal wharf to the Government wharf and thence in line with the face of the Government wharf easterly to its intersection with the west side of Church street produced southerly into the river and thence southeasterly to the west end of Bayfield shoal, is now clear of all obstructions to a depth of 21.5 feet below elevation 582.57 above M.S.L., New York, with the exception of a small shoal spot lying 300 feet 192° (S. 15° 15" W. mag.) from the southwest corner of the Government wharf, which has a depth of 21 feet below the above-mentioned elevation.

The depth of 21.5 feet above referred to is one foot below the lower sill of the Canadian lock.

The depth of the American channel in this locality is 2.4 feet below the lower sill of the Canadian lock.

N. to M. No. 5 (15) 14-2-21.

Variations in 1921—3° 15' W.

Authority—Report from Department of Public Works, Ottawa.

Publication—U. S. Lake Survey Bulletin No. 29, page 114.

Departmental File—No. 37379.

E. HAWKEN,
Acting Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 14th February, 1921.

Pilots, masters or others are earnestly requested to send information of dangers, changes in aids to navigation, notice of new shoals or channels, errors in publications, or any other facts affecting the navigation of Canadian waters to the Chief Engineer, Department of Marine and Fisheries, Ottawa, Canada. Such communications can be mailed free of Canadian postage.

PALM OIL AS A FUEL

The world's supply of mineral oil is limited. At least, so say geologists, so that the experiments with vegetable oil as a motor fuel should be of decided interest. The oil used in these experiments has been palm oil, well known in the commercial markets as one of the most desirable ingredients of the nut-margarines. The tests have been carried on in Brussels, with a view of making use of palm oil, if practicable, as a motor fuel in the Kongo. The difficulty of transporting mineral oil to the Kongo, and its high cost when delivered —about $1.40 per gallon—made the finding of a substitute a great desideratum. And, as palm oil was one of the products of the Kongo, and could be had there for about 20 cents a gallon, the reward for its successful adaptation was alluring.

The calorific value of palm oil varies from 75 to 80 per cent. of that of mineral oil; therefore, from one-fourth to one-third more must be burned to get the same power.

The experiments have proved that palm oil will work perfectly in a certain form of motor of a semi-Diesel type without any change, in the ordinary Kongo temperatures. In Belgium, however, where the winter temperatures are below the solidifying point of palm oil, an accessory is necessary to liquefy the oil. Further, in Belgian winter temperatures it has been advisable to start the motor with petroleum, and when it is well warmed up to substitute the palm oil.

The experiments have shown that palm oil burns completely, leaving no residue. So far the trials have been made chiefly on motor boats, but they are being extended to tractors and industrial motors. In July, 1920, the Belgian Ministry of Colonies initiated a prize contest for tractors operated on any of the vegetable oils produced in the Kongo. Only one contestant appeared—an evidence of the lack of research along this line.

With the passing of petroleum, an eventuality already being discounted by the geologists, the practically unlimited production of vegetable motor oils may easily become one of the important industries of the near future.

Cleveland.—There has been a small demand for tonnage for coal cargoes, but not in other lines. The first steamer to be moved this season was the F. E. Taplin, which left Detroit, where she was wintered, for Toledo, Ohio, ports, and there is a general wakening of activity.

Paying Dividend.—A dividend of 2 per cent. on the preferred stock and 1¼ per cent. on the ordinary stock of the Nova Scotia Steel & Coal Co. has been declared, payable on April 15, 1921, to shareholders of record at the close of business on March 31, 1921.

Goderich.—The National Shipbuilding Company of Goderich, which built a number of marine steam engines for the British Admiralty and for the French trawlers during the war, have now taken up the manufacture of flax pulling machinery, and are asking the municipality to guarantee a bond issue.

A. M. Wiseman, secretary to Capt. E. J. Edwards, of the British Trade Commission, who has been ill at the hospital at St. Anne de Bellevue for the past several weeks, will shortly be transferred to the Winnipeg office of the Commission to take charge of the Western territory, and will probably remain in the West for a considerable period.

The Engineering Sales and Service Company, of 179 Duke street, Montreal, have completed arrangements with their principals, the American Crucible Products Company, of Elyria, Ohio., for the manufacture of Promet at their factory in Montreal. It is expected that in a very short time equipment will be installed for the production of this metal, so that Canadian consumers and users will be assured of ample supply for all their needs.

Cobourg.—An enquiry into the circumstances surrounding the stranding of the ferry Ontario No. 2, while on a voyage from Charlotte, N.Y., to Cobourg, resulted in the first officer's certificate being suspended for three months. The captain's certificates, in view of his long and unblemished service, was not dealt with, but he was reprimanded for leaving the bridge in charge of an inefficient man during the second officer's temporary absence. The method of keeping the engine-room log was also criticized.

Navigation Open.—All previous records were swept away when the St. Lawrence was freed of ice and the first vessel entered the harbor of Montreal on March 28th. This is a month earlier than ever in the history of the port, the average time for the first arrival being April 25th. It is likely that some of the vessels now on the ocean will be instructed to come to Montreal instead of docking at St. John or Halifax.

The steamer Dalhousie City will open the season next Monday between Toronto and Port Dalhousie, St. Catharines and Niagara Falls. The steamer will pass through the Western Gap about 10.45 a.m.

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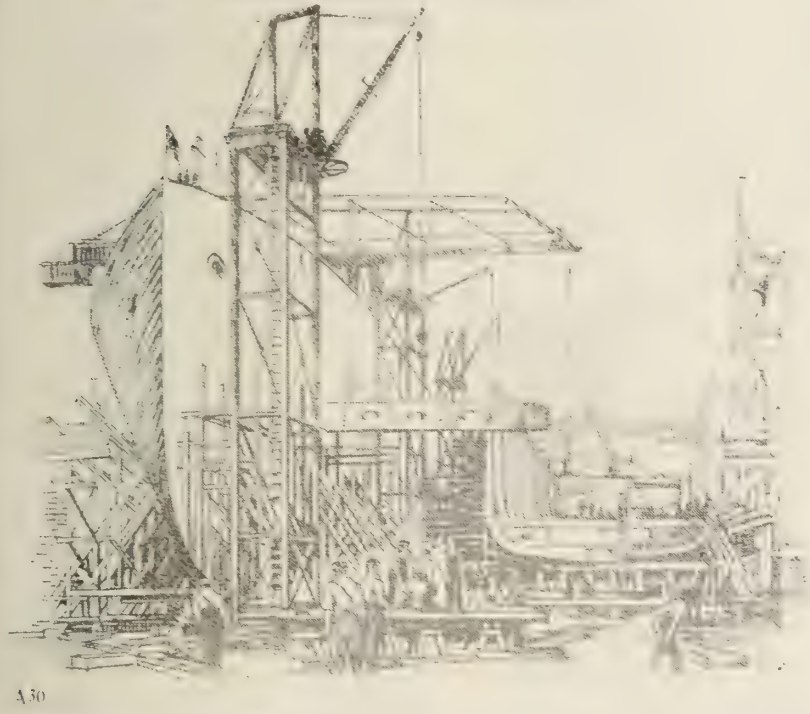

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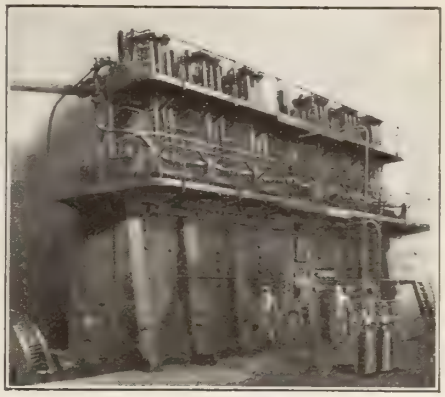

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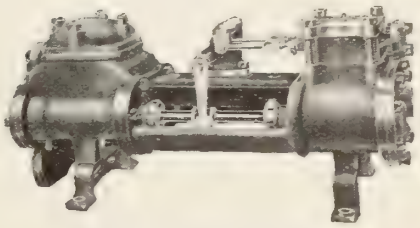

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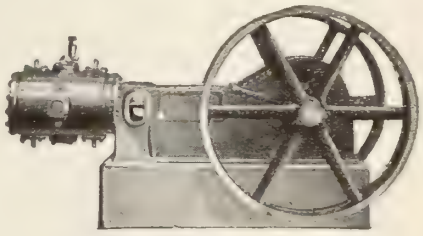

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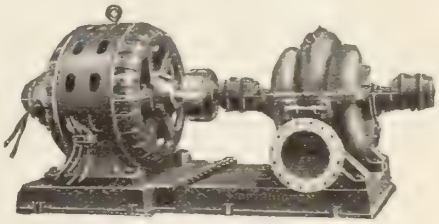

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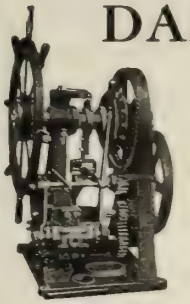

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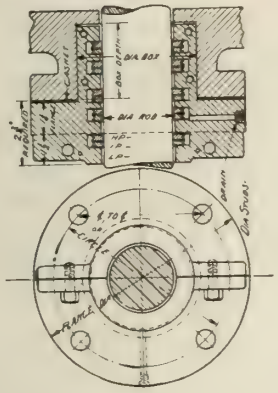

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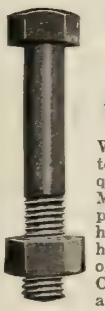

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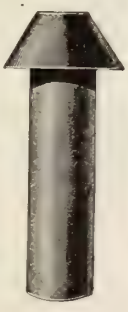

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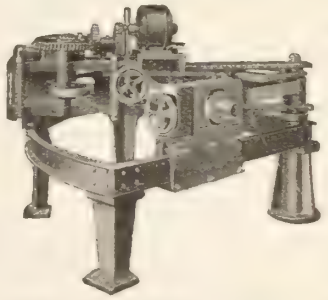

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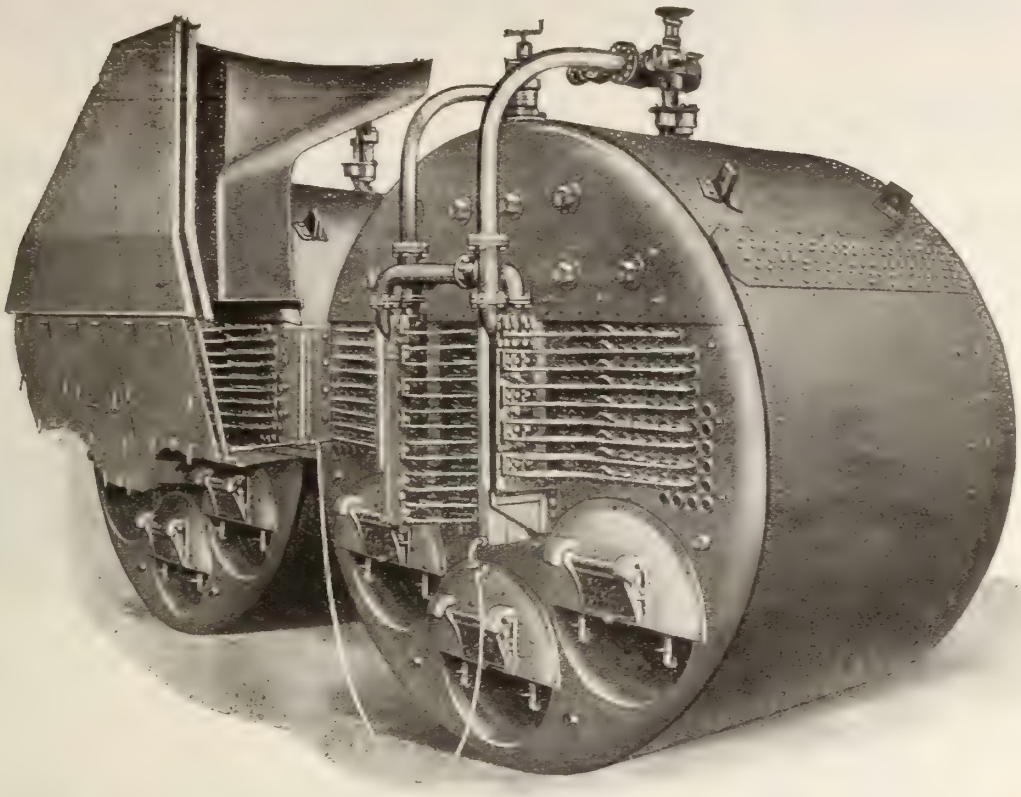

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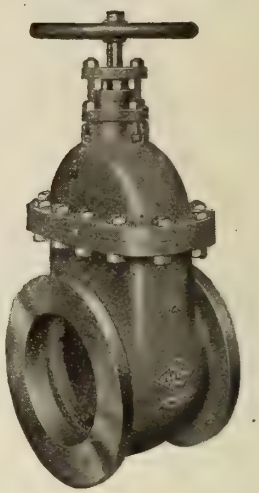

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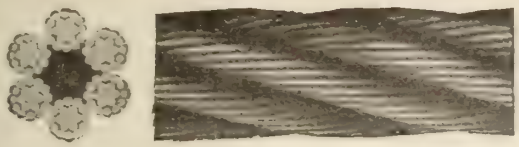

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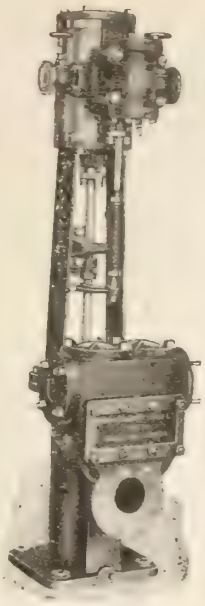

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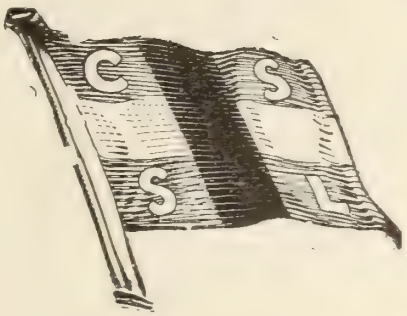

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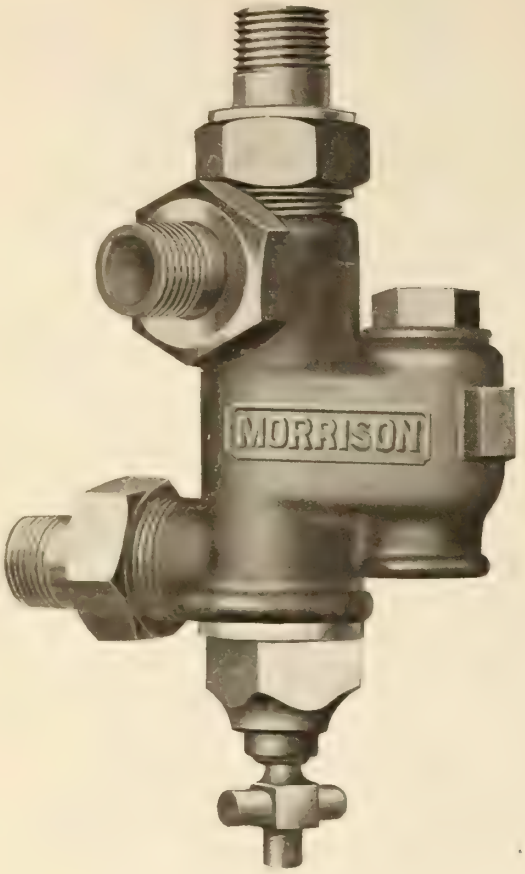

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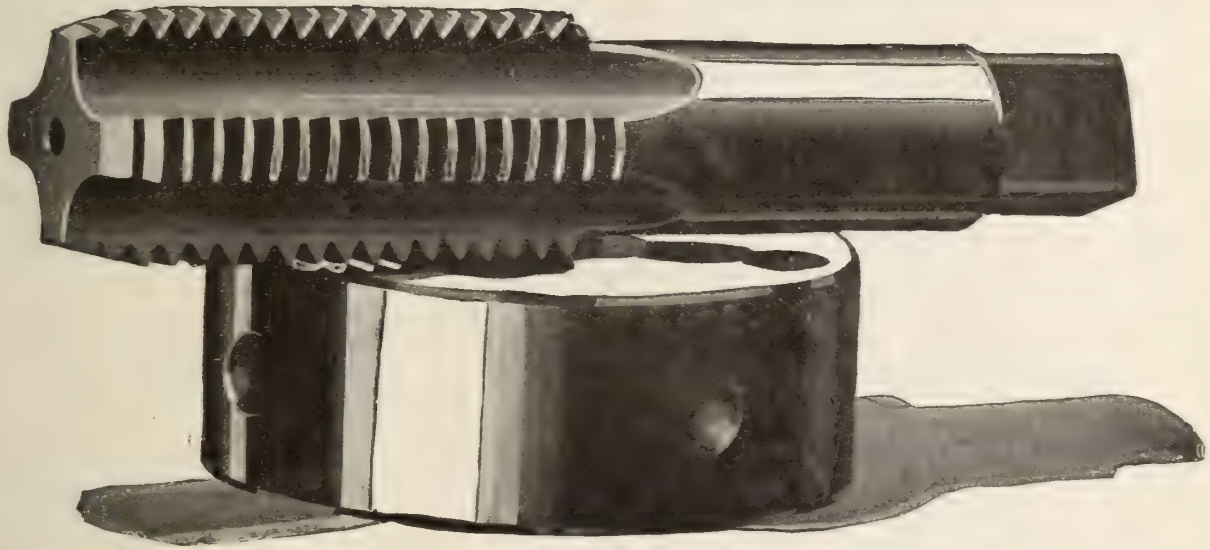

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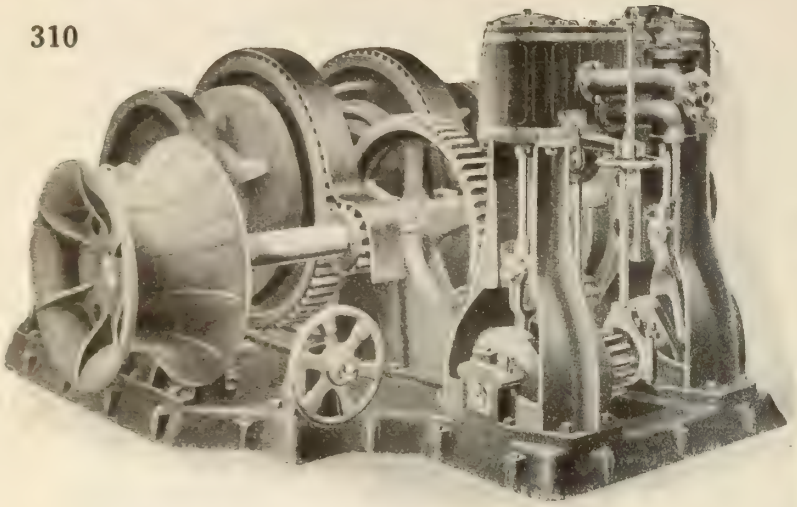

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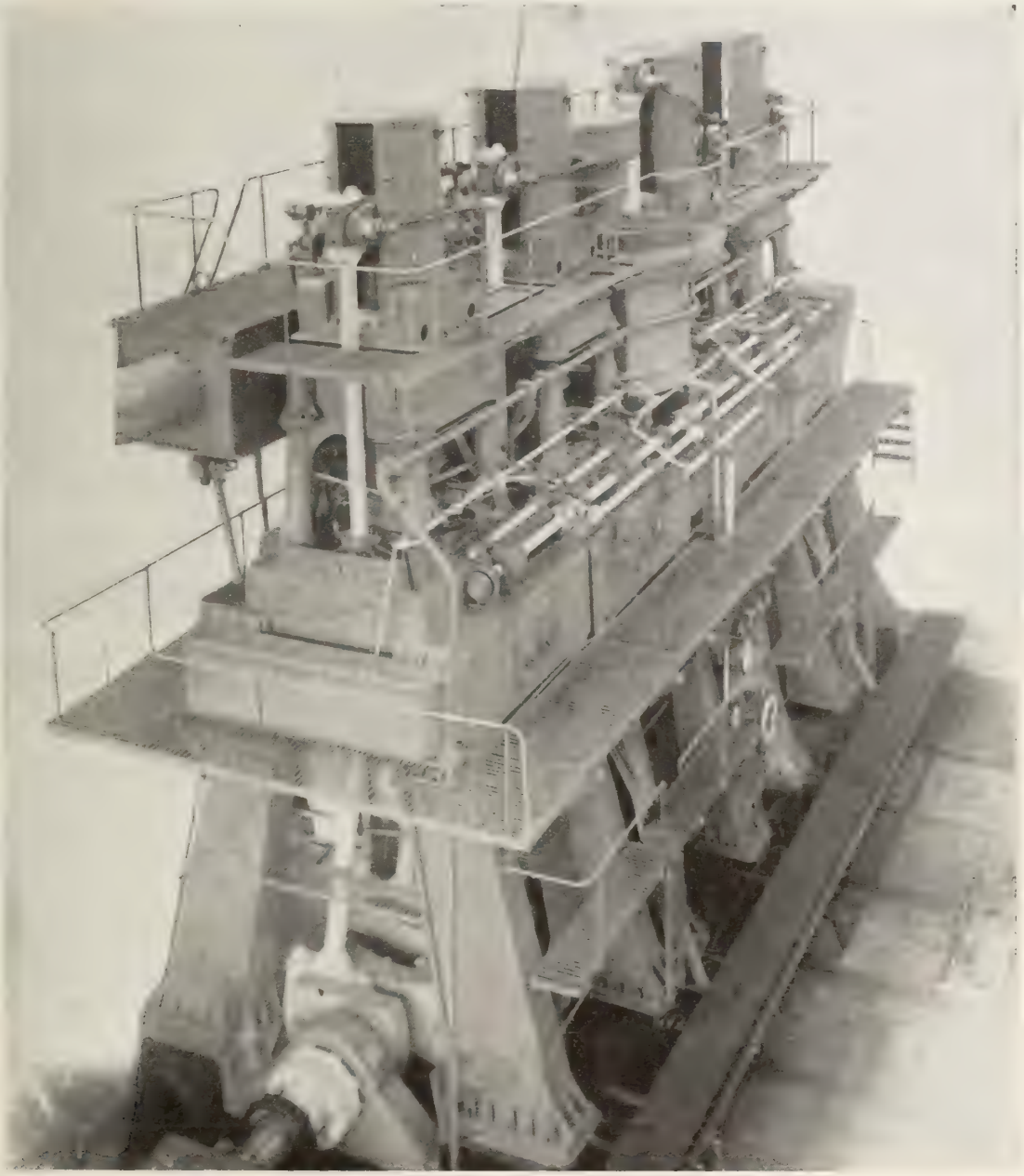

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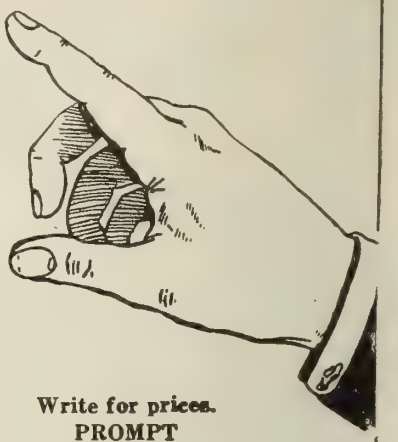

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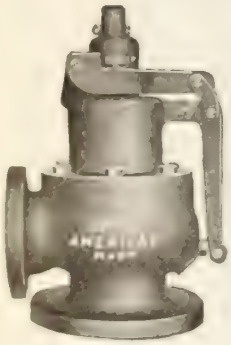

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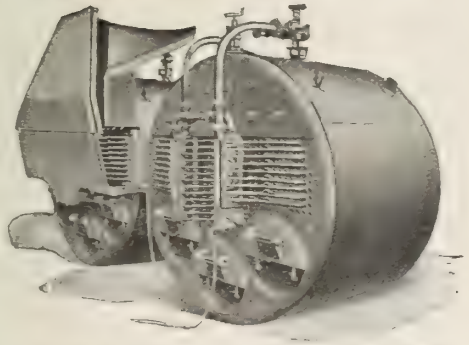

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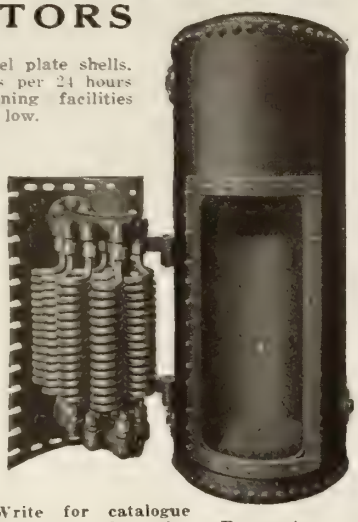

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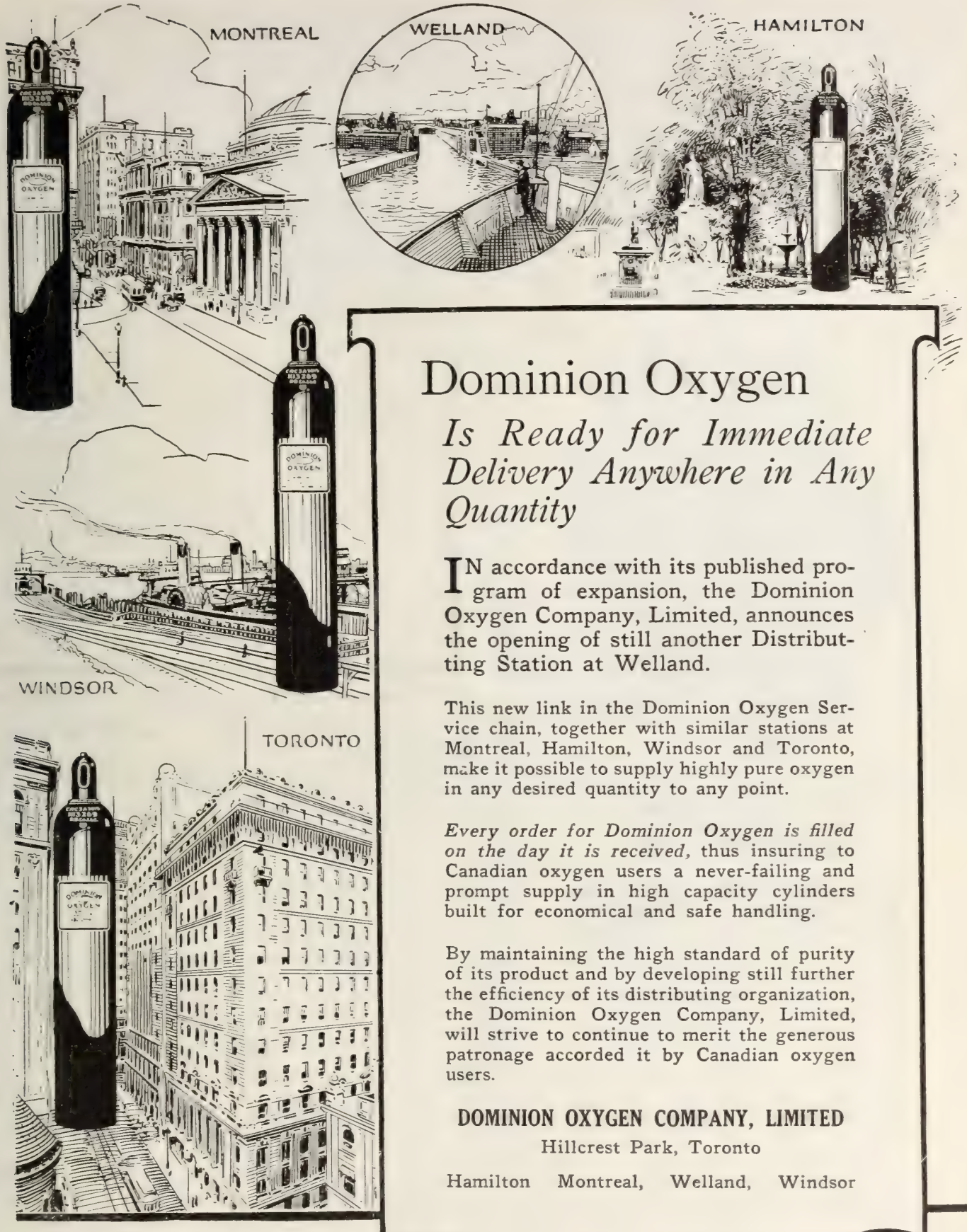

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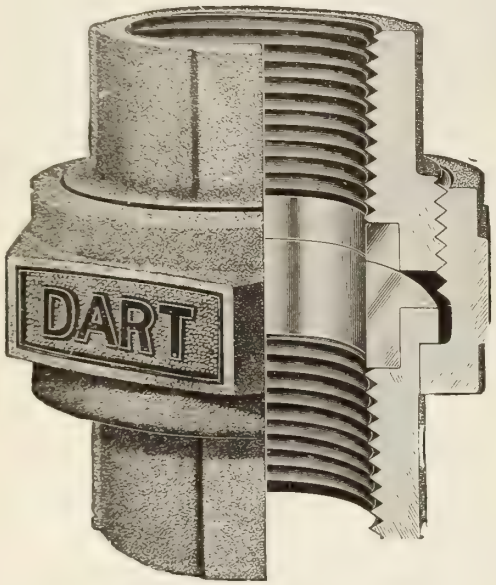

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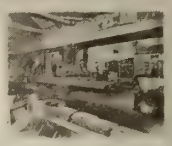

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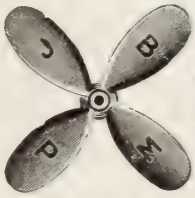

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Frank S. Cahill, M.P.—keenest critic in the House of Commons of the Government in railway matters—has written for April 15th MACLEAN'S a striking article, in which he calls for the handing over of the railways to a private corporation—*to run properly.*

Also, in another striking article a prominent, nationally-famous, business man calls for the appointment of a commission of railway experts—probably (so that they may be unbiased) selected in the U.S. After a searching investigation, he advocates that:

1—Certain lines be leased to the C. P. R.;
2—Non-paying lines cut off;
3—Remaining lines handed over, on equitable basis, to private company.

What do business men think of the parliamentary committee appointed to investigate railway conditions? — "Political probe? Pah!—a bunch of amateurs!"

Review of Reviews

Squandering Uncle Sam's Billions Paul V. Collins
German Industry Recovering Lindsay Bashford
London Journalistic School Founded Lord Northcliffe
"Law-and-Order"—Coolidge Arthur C. Brooks
Rubber Substitute Discovered Pan-American Magazine
Northcliffe's Bathtub Interview Roger Lewis
African Buffalo a Fighter Charles E. Akeley
Suggested Capital-Labor Solution James Kidd
Some Queer Clubs ..... Sunday Express
Sugar From Pumpkins ..... J. N. Bishop
Present Conditions in Roumania Charles Woods
What Is Education? ..... Alexander Irvine
Germany, Shakespeare and Bacon London Times
Auction Bridge for Two A. E. Manning Foster
X-Ray Movies .... Prof. Harold E. Richards
A Vital Factor of Success . Lord Beaverbrook
Should Britain Abandon Mesopotamia? Ikbal Ali Shah
What Should Germany Pay? Bernard M. Baruch

—also

Articles — news and feature

"GIVING AWAY OUR PROFITS"—
By Agnes C. Laut.
A strong plea for Canadians to make the most of their raw product assets,—particularly pulp and fur.

"OIL IN THE SPLENDID SIXTIES"—
By Victor Lauriston.
The romantic story of the oil boom in Western Ontario half a century ago.

"OUR AUTHORS GET TOGETHER"—
By Arthur Stringer.
Union of Canadian pen-pushers and type-writer-tappers is formed in Montreal—what it means to our Country.

"THE MORAL HAZARD"—
By Guy Morton.
What happens in Spring if you insure your flivver at the valuation of a Rolls-Royce.

Fiction—bright, national

"PAWNED"—
By Frank Packard,
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By Stanley R. Hofflund.
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"NIGGER, STOP DAT FIGHT"—
By Archie McKishnie,
of Chatham, who knows how to tell a droll story of "cullud pussons." Illustrations by H. Weston Taylor.

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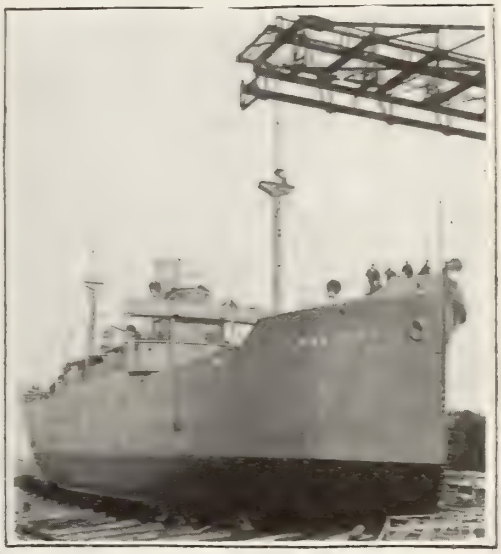

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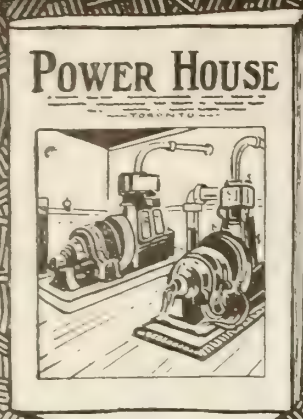

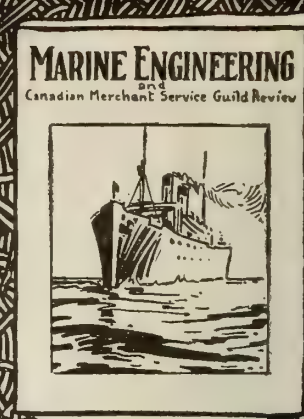

Obligations

These four dominant factors of Canadian industry —Power House, Canadian Machinery, Canadian Foundryman, and Marine Engineering—are all members of the Audit Bureau of Circulations and of the Canadian National Newspapers and Periodicals Association.

These memberships entail obligations which are a protection to both subscriber and advertiser. The first requires perfect frankness with regard to circulation. The second, that the subscribers' and advertisers' interests shall receive first consideration. MacLean Publications give their clientele absolute protection as well as service of a high order.

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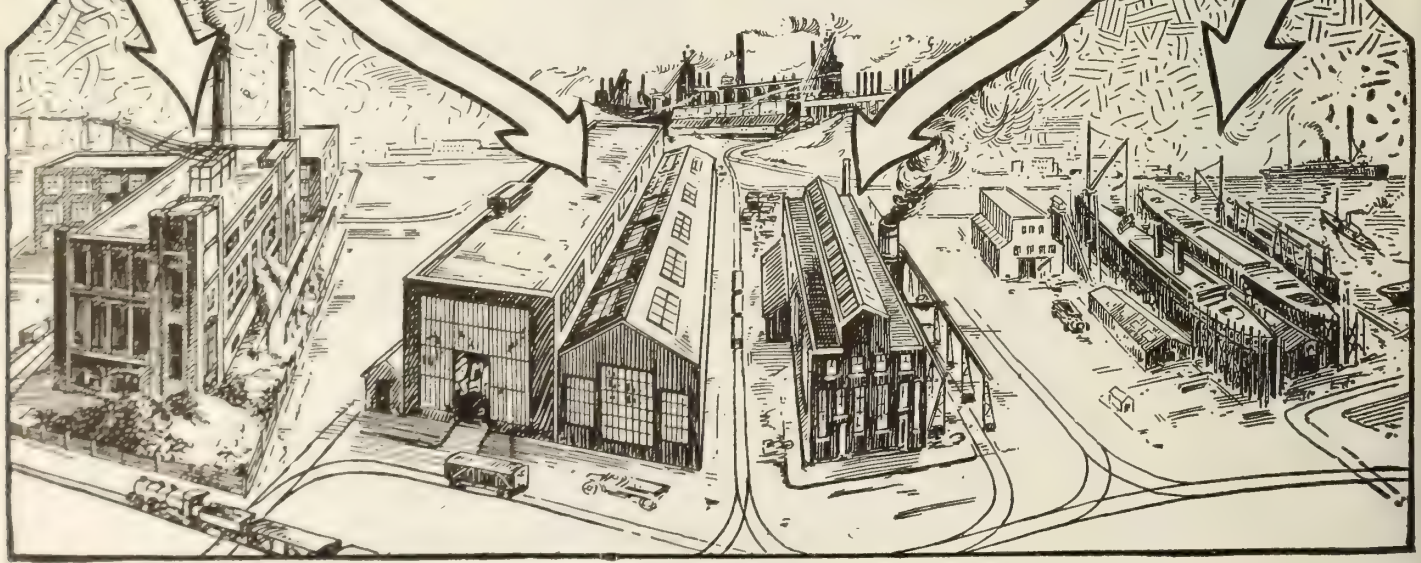

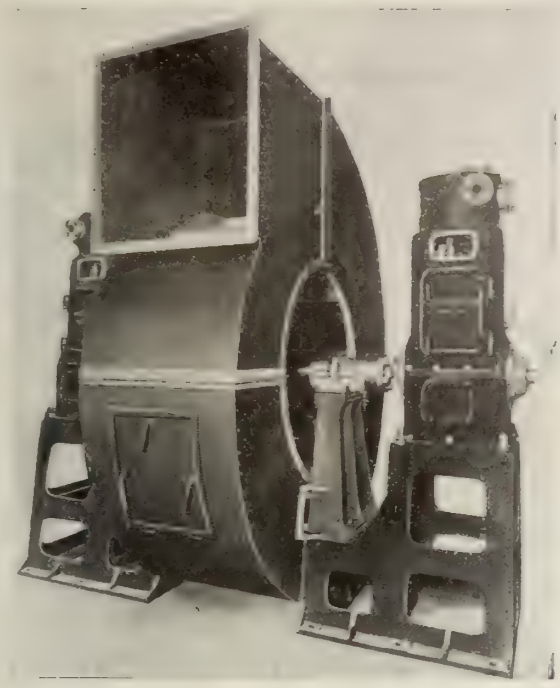

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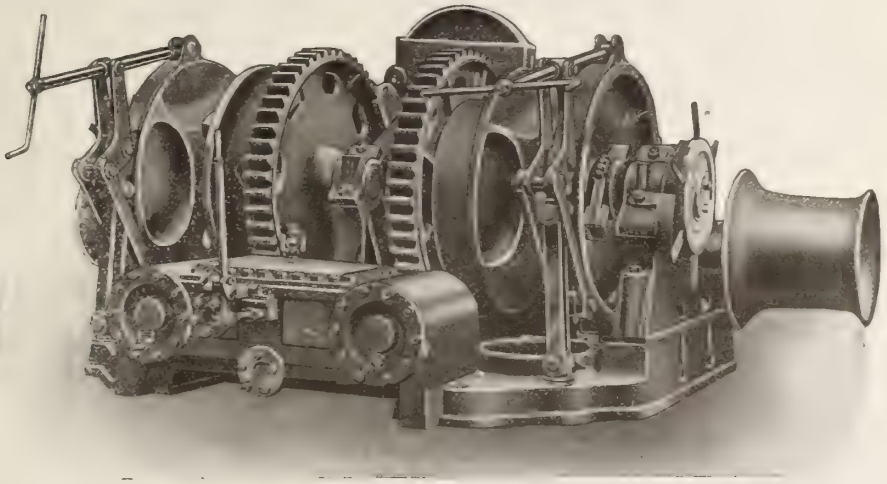

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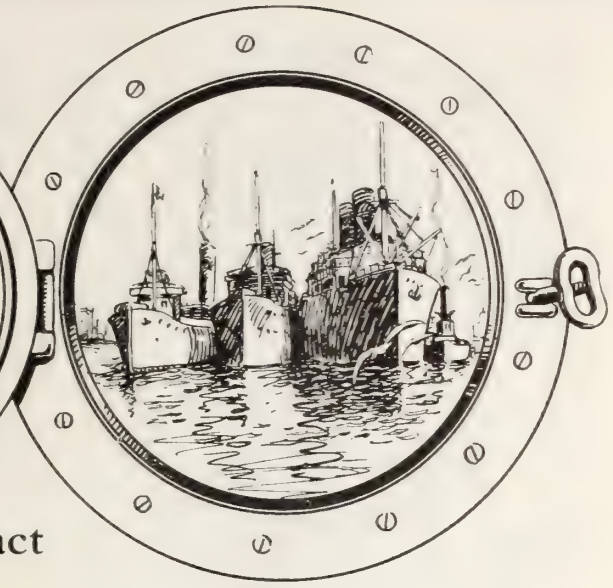

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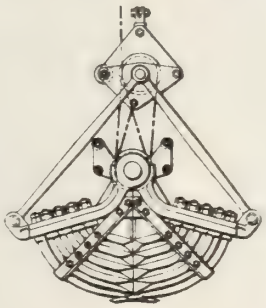

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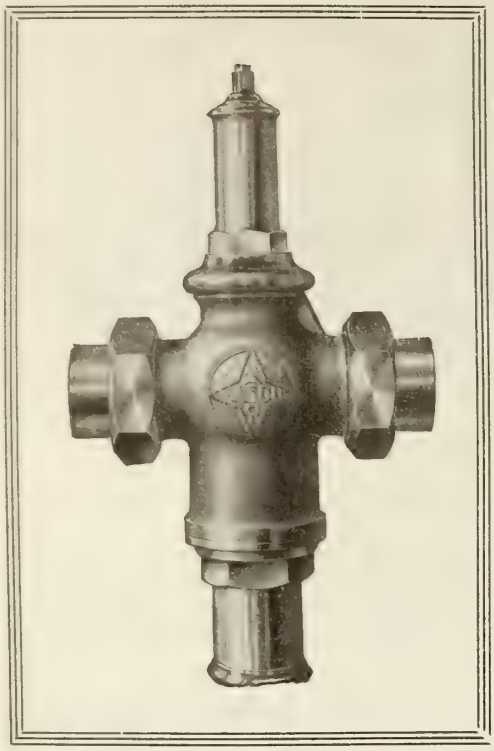

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Reilly Multi-Screen
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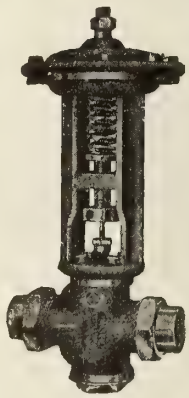

Mason No. 55 Style
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For in addition to the pumps and pumping machinery Worthington has a full complement of marine oil engines built in all sizes and ranges of horse power. The first Worthington built marine oil engine is the largest yet built on this side of the Atlantic—2400 I.H.P.

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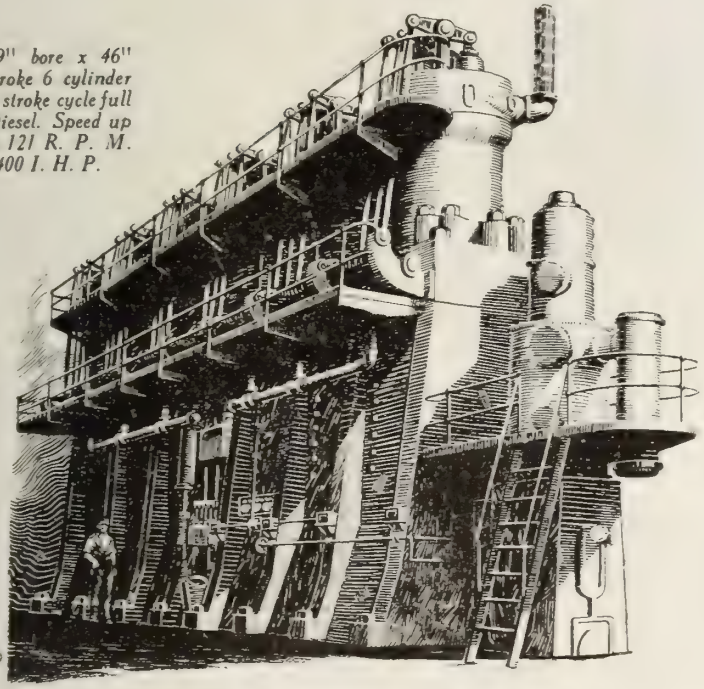

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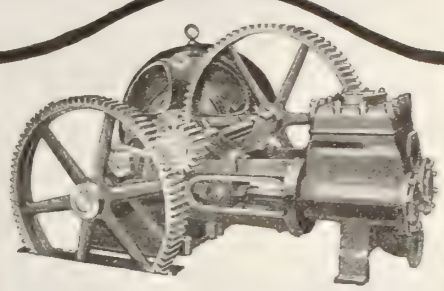
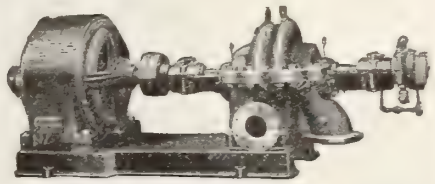
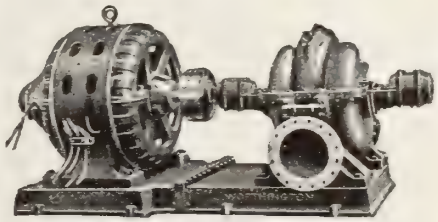


Horizontal Piston Power Pump
General duty power pump such as used for oil transfer, bilge pumping, etc. Gear guards have been removed to show more clearly the gear arrangement.



Two Stage Motor-Driven Centrifugal Pump
The two stage motor-driven centrifugal pump is being strongly suggested for fire service on motorships.



Split Case Volute Centrifugal Pump
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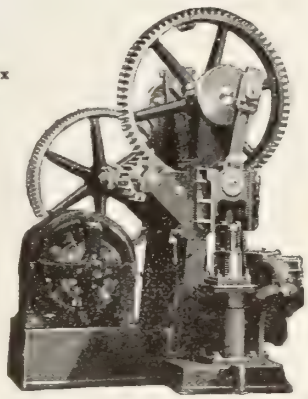
Vertical Triplex Motor-Driven Power Pump

One of the many triplex power pumps suitable for motorship use. Gear guards are always used on these pumps but are left off here to show construction.



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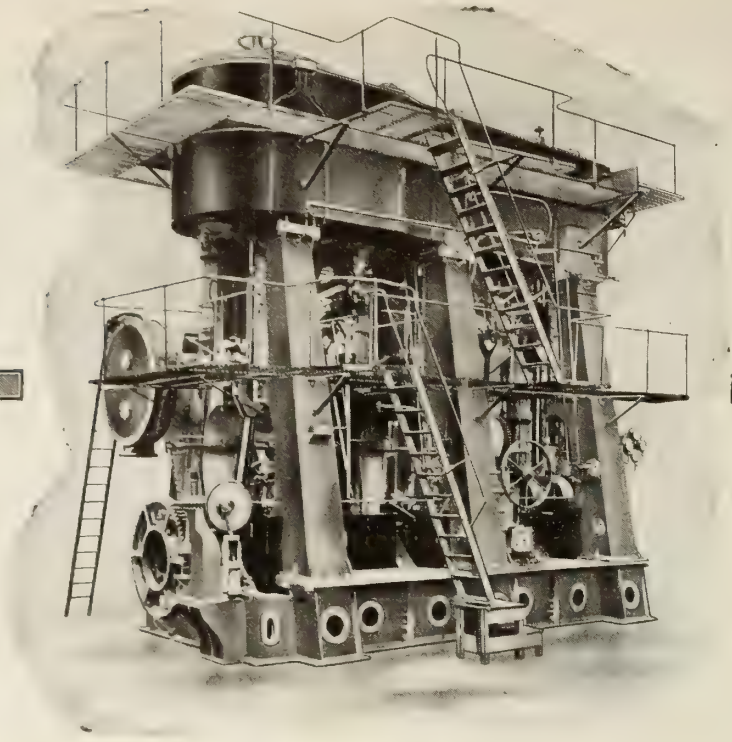

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MARINE ENGINEERING
OF CANADA

Vol. XI. APRIL, 1921 No. 4

The First True Diesel Made In Canada

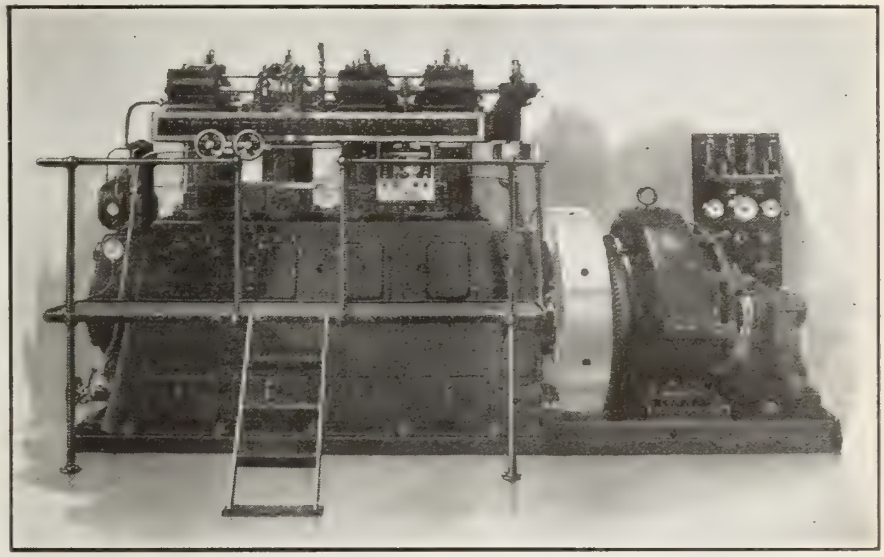
The History of the Diesel Engine—Two-Cycle, Four-Cycle, Solid Injection and Atomised Injection—General Description of the D. S. P. 100 B. H. P. 4-Cylinder Diesel

THOSE people who were interested in the exhibits shown in the Machinery Hall at the Toronto Exposition last year doubtless all stopped for a more or less interested look at a new kind of engine. This was the 125 h.p. Diesel exhibited by the Dominion Steel Products Co. of Brantford, and the first of its kind to be built in Canada. It is of the full or true Diesel type, as distinguished from the hot bulb or other surface ignition engines. This type of engine will doubtless have a great part in the developing of some of the outlying parts of our country, and every engineer should understand its principles and operating features.

The History of the Diesel

The Diesel engine should really be known as the Ackroyd Priestman engine, as the cycle it works on was first mooted by these two engineers in England, some years before Dr. Diesel took up the study of this principle. However, Dr. Diesel is usually conceded to be the man who first actually demonstrated its possibilities, and the basic patents were taken out by him in 1892. He built his first engine in 1893, and this was driven by a belt and did not do any work. What it did do, however, was to prove that oil could be ignited by the heat of compression of air, which is the main feature of the true Diesel engine. In the experimental engine, Dr. Diesel obtained a pressure of 1,350 pounds per square inch, and incidentally when the fuel was injected, the explosion that followed wrecked the engine. It almost resulted in the death of the inventor, but he rose from the ruins triumphant, for, even if the engine was demolished, the principle was established that the fuel could be ignited by means of the heat of compression.

Another engine was built, this time the compression being kept down to 500 pounds per square inch, and on this occasion the full cycle was obtained. Later another engine was built, with the cylinder water cooled, in 1896. Dr. Diesel sold his patents in 1897 for the sum of $1,500,000, so unlike many inventors, he actually realized the reward of his endeavor. His life ended in a tragic manner, he being lost at sea while journeying from Antwerp to Harwich in the year 1913.



D.S.P. H.C. OIL ENGINE. FOR CENTRAL STATION SERVICE.

The Cycle of Operation

The Diesel engine is built in two principal types, the two and four stroke cycle. These types are divided again into other modified classifications. In general, the two stroke cycle gets an ignition at each revolution, and the four stroke cycle receives an impulse every second revolution. In the two cycle type, on the inward or upward stroke of the piston, the products of combustion are discharged, and a fresh charge of air drawn in and compressed. At the top of the stroke the fuel is injected, and the down stroke is the working stroke. In this type the scavenging, or getting rid of the exhaust gases, is a difficult problem, and various means are employed to effect it. The simplest, and most generally used, is crank case compression. The piston descending on the downward stroke, compresses the air in the crank case to five or ten pounds, and this air sweeps through ports on one side of the cylinder when uncovered by the piston, and drives the gases out through a set of ports on the opposite side of the cylinder. Enough air is received on top of the piston to give the necessary compression. In other types the scavenging is done by a separate pump. Then there is the opposed piston type, in which the compression takes place between two pistons in one cylinder, and the working stroke is obtained by one piston ascending and the other descending. These work on three cranks, two of them being at 180 degrees to the other. The top piston is supplied with a crosshead, from which two connecting rods are connected to the two cranks at the outside, while the bottom piston is attached to the centre crank. When explosion or ignition takes place, the top piston pulls the two outer cranks up, while the centre crank is pushed down by the bottom piston. This type is known as the Junker, pronounced Yunker. Very often the scavenging in this type is done by a separate air compressor, instead of using the crank case compression.

The four cycle type is divided into solid injection and air spray injection.

In the solid injection type the fuel is injected by a fuel pump working at a pressure of 6,000 to 8,000 lbs., directly into the combustion chamber. In the air spray type, which is the one we are about to describe, the fuel is injected into a chamber containing compressed air at a pressure of about 1,000 lbs. per sq. inch, and shot into the combustion chamber as a finely atomized mixture of air and oil.

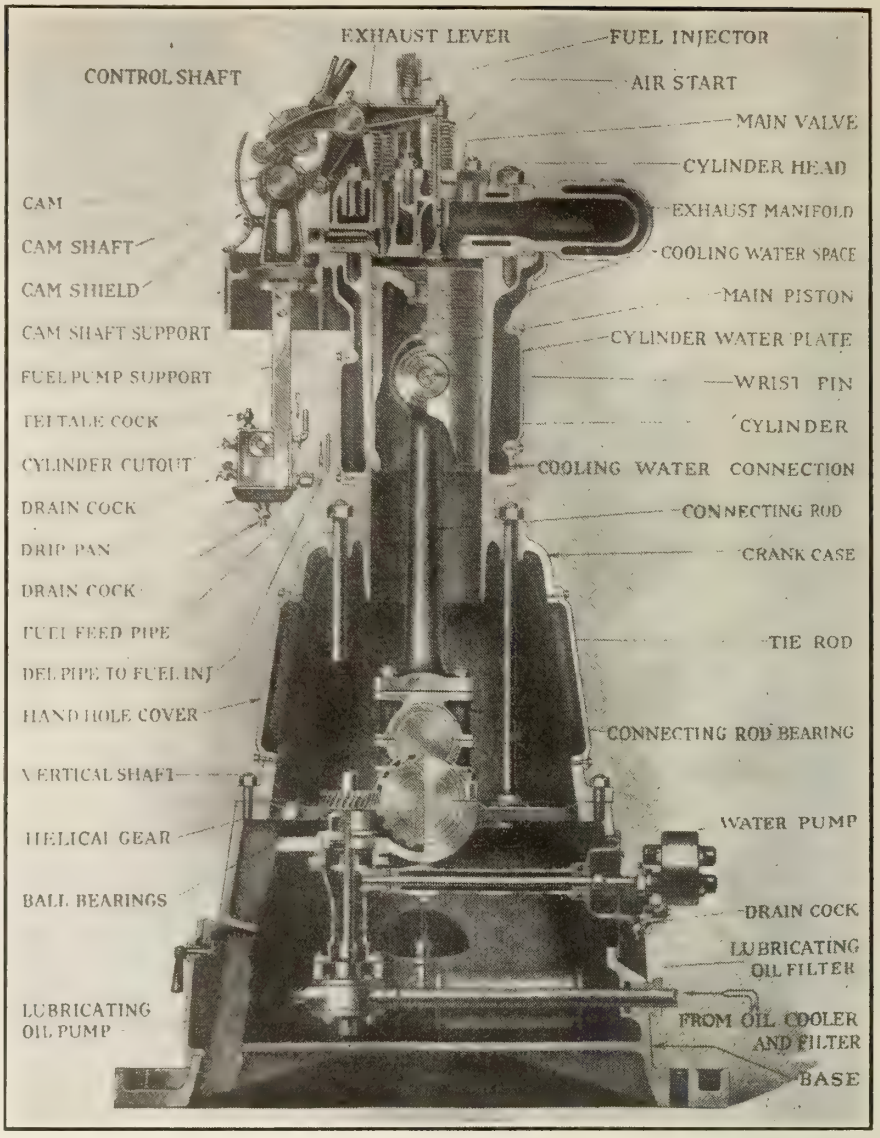
The two types have their different adherents, the solid injection school claiming that their method does away with the necessity of an air compressor steadily running, while the air spray school claim better combustion, which amply makes up for any supposed disadvantage from the use of a high-pressure air compressor.

The Four Cycle Type

In the four cycle type the first downward stroke, or outward stroke perhaps is a better way to put it, draws in a charge of pure air from the atmosphere, not the crank case. On the inward stroke this air is compressed to the required pressure, about 550 lbs., and at the top of the stroke the finely atomized fuel is injected by the air pressure from the air compressor delivery chamber. Ignition takes place at constant pressure, and the third stroke is the working stroke. On the fourth stroke the exhaust gases are discharged through a special exhaust valve and the cylinder is ready for the cycle to be repeated. The cycle may be described as suction, compression, expansion, and exhaust.

The D.S.P. Engine

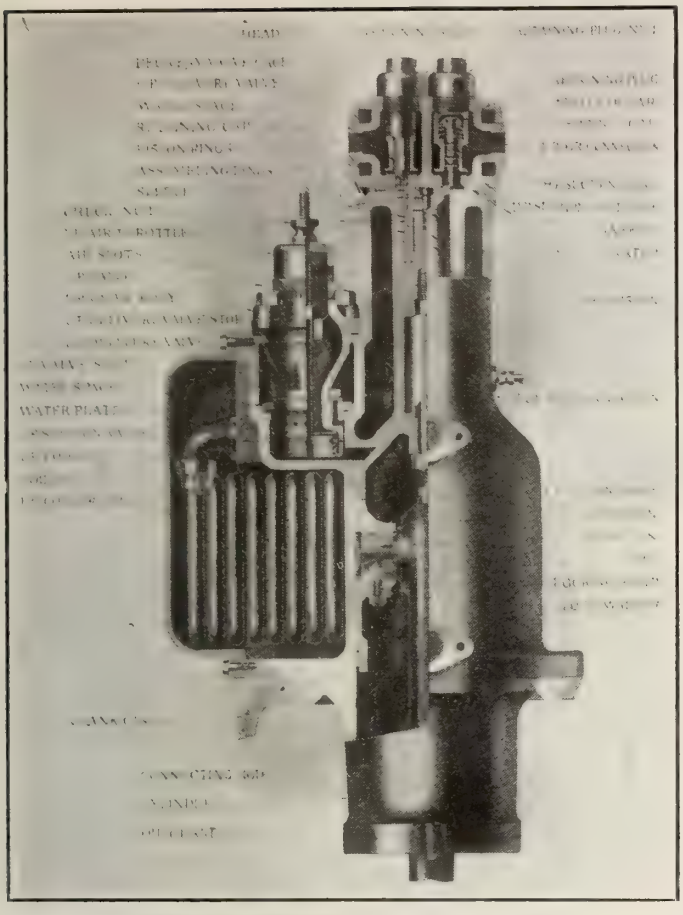
The illustration herewith gives a good idea of the outside appearance of the engine, directly connected to a generator, for power and lighting service. This is exactly as the engine appears in the shop where it is now engaged in running a number of machines and overhead cranes. The engine is four-cylinder, four cycle, spray injection. On the end opposite the flywheel and generator is the air compressor for injecting the fuel, and supplying the air bottles, which are used for starting purposes. On the front can be seen the fuel pump. Both of these pieces of apparatus will be described fully later on. The engine operates on crude oil, with a specific gravity of about .865, or even higher, but with this specific gravity the oil will flow without heating in to the fuel pump. The efficiency of the engine is high, as it will deliver practically 30 per cent. of the fuel energy at the pulley as useful work. This is, of course, much bigger than with any type of steam prime mover, and is attained in the Diesel engine because the fuel combustion takes place in the same chamber that the work is done in. With the steam engine, the combustion takes place in a furnace, the heat is conveyed through the plates of the boiler into the water, and then carried by the steam through piping into a cylinder or turbine casing, with many losses on the way due to radiation and friction.



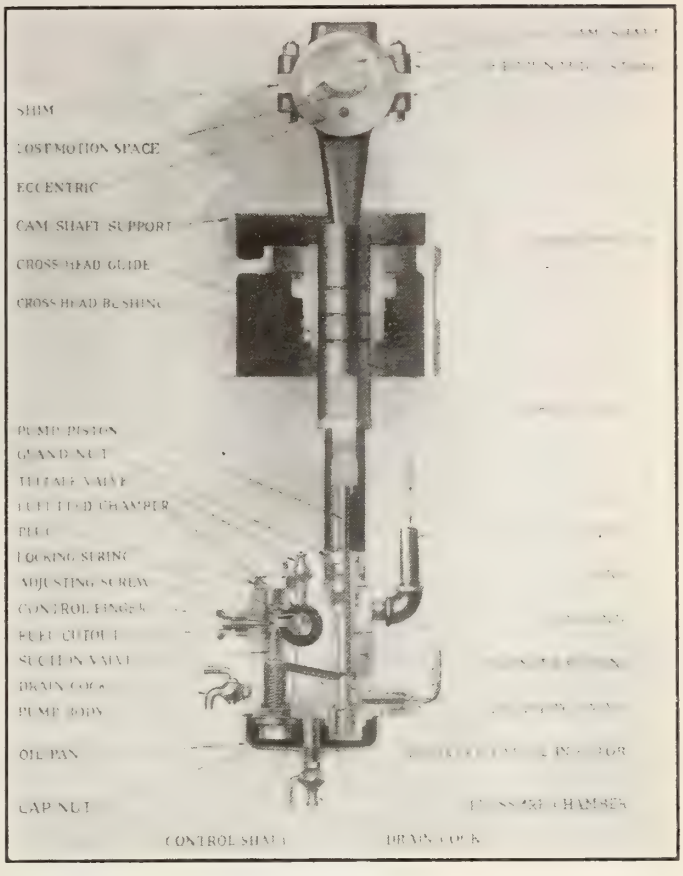
CROSS SECTION THROUGH CYLINDER.

In the engine we are dealing with compactness of design has been studied to good effect. It is necessary, of course, in an engine of this type to make provision for starting up. The method of starting is to admit compressed air to the cylinder to obtain the initial revolutions and compression. In order to do this it is necessary to have always a reserve of compressed air, and for this purpose bottles or flasks are provided, much like ammonia or oxygen cylinders. In most cases these are mounted on a wall convenient to the engine, but in the D.S.P. engine, provision has been made for carrying these bottles in the bedplate of the engine. This arrangement makes the engine absolutely self-contained, and ready to start the minute it is dropped down and secured to the foundation, and connection made to the fuel oil supply. The air is supplied to the bottles by the two stage air compressor situated on the end of the engine, and after the engine is started up this compressor supplies the air continually to the air injection valve for atomising the fuel. Such surplus air as may be delivered is diverted to the bottles.

The fuel pump is worked from a small crosshead, which is driven from a special eccentric mounted on the cam-shaft, which operates the valves. There are four plungers on this pump, one for each cylinder. The amount of fuel injected at each stroke is varied by a governor, which operates by holding the suction valve of the fuel pump open for a longer or shorter time, thus controlling the amount of fuel delivered per stroke. Holding the suction valve open, of course, is the same thing as shutting off the supply, and the speed of the engine is regulated very closely by this means. Each cylinder has the necessary valves for air start, fuel injection, and exhaust, and in addition to these, the two centre cylinders are supplied with air starting valves. These valves can be put on each cylinder if required, and the cylinder head is machined to receive them, but in practice it is only found necessary to use the two mentioned. These valves are all operated from a cam-shaft, driven



SECTION THROUGH AIR COMPRESSOR.



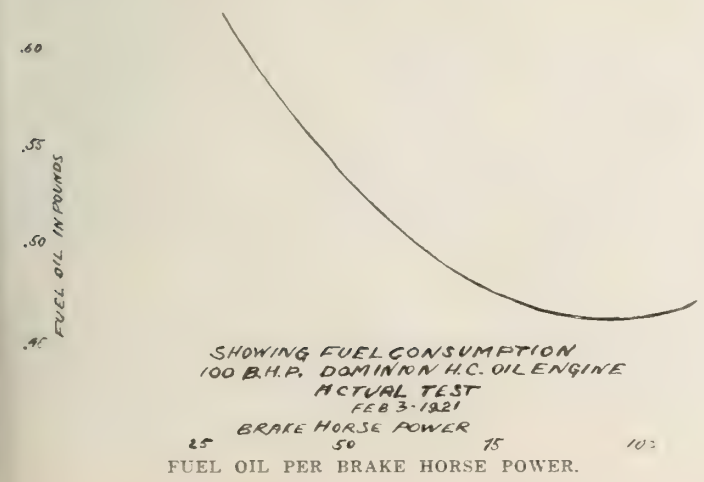
SECTION THROUGH FUEL PUMP.

by gearing from the main shaft. The cams operate levers, which open and shut the valves at the precise period of the stroke necessary to accomplish the various functions. The action of these cams is, of course, exactly the same as on a gas engine or a gasoline engine, with which most of us are familiar these days.

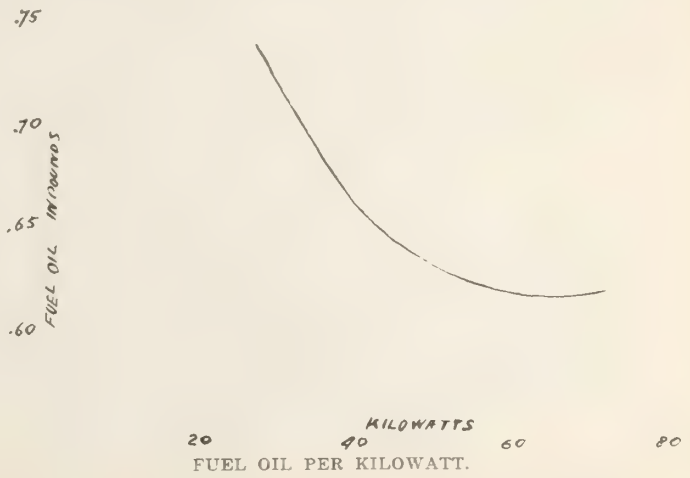
Starting the Engine

In starting the engine the following is about the method of procedure. The reserve air bottles will have been left when the engine shut down with a pressure of about 950 to 1,000 pounds, and will have, perhaps, dropped owing to the cooling of the air to about 800 lbs. or perhaps a little less. The operator first of all raises the relief valves of the cylinders by means of a special lever, which action releases the compression in the cylinders, and allows him to bar the engine round to the air start position. This position is, of course, that in which the air start valves on the two inside cylinders will be open for the admission of air. He then closes the relief valves again, and opens the valve from the air bottle. The engine immediately turns over, and the operator, who has previously seen that the fuel tank is full and ready for the day's work, opens the fuel control valve to give fuel to the pump, and closes off the air start valves by means of a control lever, which puts the air start lever into neutral position. This particular engine usually picks up after a couple of revolutions from dead cold. The operator comes in about ten minutes before starting time, looks at his fuel tank, gives a general look around the engine, and starts her up about five minutes to the hour, and is all ready with the current at the switchboard when the shop is ready to start.

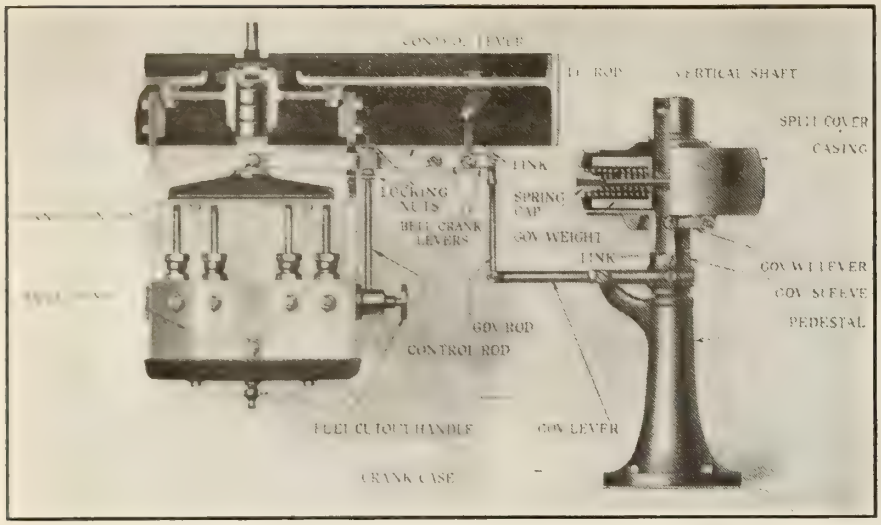
Once started, the engine requires practically no attention. The air compressor draws in the air from the atmosphere, passes it over the element containing the air coming from the low pressure stage to the high pressure stage, thus cooling the latter, passes the air through its two stages, the final delivery pressure being from 900 to 1,100 lbs., according to the load being carried. This air is delivered to a chamber on top of the cylinder, and at the proper moment the fuel from the fuel pump is injected into this chamber and the valve from the chamber into the cylinder is opened, and the finely atomised spray of oil fuel injected. Ignition takes place without shock and combustion at practically constant pressure



FUEL OIL PER BRAKE HORSE POWER.



FUEL OIL PER KILOWATT.



THE GOVERNOR AND CONNECTIONS.

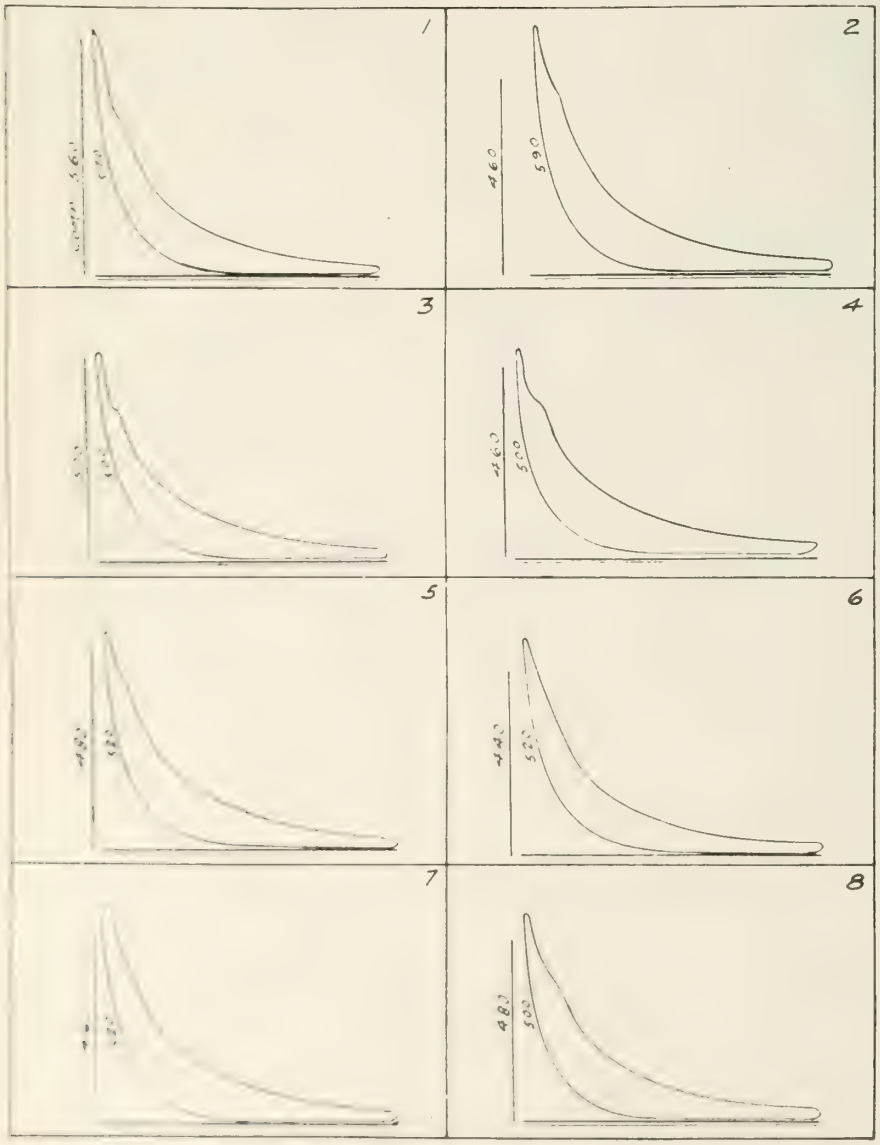
ensues, the gases expanding and driving out the piston. At a point just before the bottom of the working stroke is reached, the exhaust valve is opened, and held open throughout the return stroke discharging the exhaust gases. At about the top of the stroke, the cam closes the exhaust valve, and opens the air suction valve, and the cylinder is filled full of pure air. The valves are then all closed, while compression takes place on the fourth stroke, and at the end of this stroke ignition again occurs.

A pump situated in the base of the engine supplies oil under a pressure of ten to fifteen pounds to the crank pin, and through the connecting rod to the wrist pin, while special lubrication is supplied to the piston. The air compressor is lubricated by the oily spray generated in the crank pit by the passing of the cranks through the oil bath, and this is all the lubrication employed for the air compressor.

The accompanying illustration shows the typical indicator cards obtained from this engine, while the section cuts explain very clearly the working parts. Fuel consumption is shown by the curves illustrated here.

A representative of Marine Engineering had the opportunity recently of seeing this engine performing its daily task, and was impressed with its splendid performance under somewhat difficult circumstances. This engine was built with an ordinary sized flywheel, to drive a generator on fairly constant load. The work it is doing now is under very considerable variation of load, from no load to a 50 per cent. momentary overload occurring frequently. The speed regulation under these conditions was excellent, and standing at the exhaust pipe, the only indication of anything unusual was a puff of blue smoke. At ordinary load the exhaust was practically invisible, showing excellent conditions.

The Dominion Steel Products are to be congratulated on being the pioneers in Canada of this type of prime mover, and its development will be watched with interest by the engineering profession in general. Mr. Brown, the designer of the engine, gave a highly interesting lecture on the engine before the Canadian Association of Stationary Engineers recently, which was well attended, and discussed with interest by those present.



TYPICAL INDICATOR CARDS.

POINTS ON CONSTANT PRESSURE DIESEL ENGINE.

It can use high compression pressures as it does not compress a mixture.

The mixture is very lean and burns slowly and loss in cooling water is less.

Four gallons of cooling water per B.H.P. ample.

Perfect combustion due to complete atomizing and slow burning.

Oil of high flash point, thus cheap oil can be used.

Typical test data:—

Compression pressure per square inch, 510 lbs.

Mechanical efficiency, 82.5 lbs.

Fuel consumption per B.H.P., .45 lbs.

Cooling water Temp.—in, 46 deg. F.

Cooling water Temp.—out, 103 deg. F.

Exhaust gases, temperature, 600 deg. F.

Heat value of fuel, B.T.U., 19,000.

Specific gravity of fuel, B.T.U., 86.5.

It has been announced that the contract has been let for the erection of a ten-story hotel structure at the corner of London Street and Dougal Avenue, Windsor. Estimated cost $2,188,500.

Captains and Engineers Appointed on the Canadian Inland Steamships

ALGOMA CENTRAL STEAMSHIP LINE

Vessel	Captain	Engineer
W. C. Franz	W. C. Joran	A. M. McInnes
J. F. Taylor	J. D. Montgomery	Albert Chalmers
Agwa	M. A. Livingstone	John Smith
Home Smith	A. McIntyre	D. McLeod

CANADA ATLANTIC TRANSIT COMPANY OF U.S.

Vessel	Captain	Engineer
Arthur Orr	John Simons	D. E. Mance
Kearsarge	H. Jaenke	J. W. Greiner

DEPARTMENT OF MARINE AND FISHERIES

Vessel	Captain	Engineer
Grenville	Richard Smith	James Leonard
Lambton	Alex. Brown	J. M. Brechin
Concretia	D. Mills	R. Mullins
Scout	Cory Hart	Geo. Lessard
Argenteuil	Thomas W. Weir	Alex. Drury
Vercheres	E. Aussant	H. Robitaille
Shamrock	S. Sauvageau	N. Marchand

DOMINION TRANSPORTATION COMPANY, LIMITED

Vessel	Captain	Engineer
SS. Caribou	A. A. Batten	J. Walters
SS. Manitou	N. J. McCoy	Wm. Owens

GREAT LAKES TRANSPORTATION COMPANY, LIMITED

Vessel	Captain	Engineer
Glenshee	W. A. Lavigne	F. Goodwin
Glenisla	J. Tindall	P. Eagles
Glenorchy	F. Burke	G. Price
Glenfinnan	Wm. Taylor	J. Silverthorne
Glenlyon	A. A. Hudson	D. Sinclair
Glenlivet	C. Scott	J. A. McChristie
Glenbrae	Ben Garvie	R. Knight
Glenstriven	J. A. Brown	Ed. Hurl
Glencairn	M. Stalker	J. Gilbert

THE INTERNATIONAL TRANSIT COMPANY

Vessel	Captain	Engineer
Algoma	M. Griffiths	Steve Burgess

GEO. HALL COAL COMPANY OF CANADA, LIMITED

Vessel	Captain	Engineer
Follette	Wm. Liddell	M. J. McFaul
Morrow	R. Chatel	Mr. Lamoureaux
J. B. Ketchum	W. J. Jewitt	U. Hamelin
Lehigh	W. H. Ransom	F. A. Collier
Derbyshire	E. A. Groulx	O. Croteau
Rockferry	C. A. Mahoney	A. Carrier
Rugee	W. Mills	O. D. Thurston
Florence	V. Gendron	S. Legendre
Margaret Hackett	M. Allison	T. Assaunt
J. H. Hackett	W. Allison	J. Desrocher
Ewen	P. Leboeuf	
Gladys	A. D. Brunet	
Zapotec	A. Derepentigny	

IMPERIAL OIL LIMITED

Vessel	Captain	Engineer
SS. Iocolite	Robert Laing	H. R. Welch
SS. Iocoma	Harry C. Mimms	F. Pringle
SS. Imperial	Geo. MacKay	S. E. Brisbin
SS. Royalite	Alex. Geddes	S. H. Phillips
SS. Sarnolite	C. R. Treweek	J. P. Davidson
SS. Impoco	W. R. Smeltzer	Arch. McLaren
SS Imperoyal	D. Sutherland	D. J. Dow
SS. Talaralite	F. F. Foote	Chas. T. Martin
Barge No. 41	Ed. Dahl	

MULLEN COAL COMPANY

Vessel	Captain	Engineer
Alaska	Jos. E. Mahon	Chas. Burns
John Otis	T. W. Lawler	G. H. Braun
Barge S. J. Tilden	T. Birkeland	

MARINE NAVIGATION COMPANY OF CANADA, LTD.

Vessel	Captain	Engineer
SS. Alston	Capt. Wyatt	Eng. Wrigglesworth
SS. Cape Corso	Capt. Cherry	Eng. McCall

ONTARIO CAR FERRY COMPANY, LIMITED

Vessel	Captain	Engineer
Ontario No. 1	S. McCaig	D. L. Smyth
Ontario No. 2	F. D. Forrest	J. Alan Nicoll

PORT HURON AND SARNIA FERRY COMPANY

Vessel	Captain	Engineer
Omar D. Conger	Wm. S. Major	R. A. Campbell
City of Cheboygan	Geo. Waugh	D. B. Smith
Hiawatha	E. Thomas	H. S. Myers

PRESCOTT AND OGDENSBURG FERRY COMPANY, LTD.

Vessel	Captain	Engineer
Miss Vandenberg	A. Black	Fred. Lavery
Ferdinand	S. J. Delaney	W. J. Jento

KEYSTONE TRANSPORTS LIMITED

Vessel	Captain	Engineer
SS. Weywest	J. De los Whiteley	Alex. Horton
SS. Keyport	Geo. Bunting	Louis Nordnes
SS. Keybell	Leo. Beaupre	R. J. Muchmore
SS. Keyvive	Ed. Smith	Geo. Baker
SS. Keynor	Wm. Smith	Jas. Boak

MARQUETTE AND BESSEMER DOCK AND NAVIGATION COMPANY

Vessel	Captain	Engineer
M. & B. No. 2	Jno. Van Buskirk	J. Stevens

CANADIAN TOWING AND WRECKING COMPANY, LTD.

Vessel	Captain	Engineer
Tug Jas. Whalen	A. G. McKay	H. Cross
Tug Sarnia	Capt. Burke	Not Appointed
Tug A. F. Bowman	Not Appointed	Not Appointed
Barge Empire	Not Appointed	Not Appointed
Barge Coteau	Not Appointed	Not Appointed
B'ge M. E. McLach'n	Not Appointed	Not Appointed
Steamer Gogebic	Not Appointed	Not Appointed

Canadian Government Merchant Marine

The Minister of Marine in His Annual Statement to the Dominion Parliament Explains the Operation of and the Present Position of the National Merchant Fleet.

IN the House of Commons at Ottawa, on March 29th, Hon. C. C. Ballantyne, Minister of Marine, presented to the House a full statement showing the operations of the C.G.M.M. up to the present time, and some details of the financial result obtained.

In his preliminary remarks, Mr. Ballantyne stated that opportunity would be afforded to members to make any criticisms which they desired or to put forward any questions.

After a general review of the conditions which led up to the Government of Canada placing large orders for shipbuilding during 1918 and 1919, and also covering the situation as regards the policy of establishing a national mercantile marine, Mr. Ballantyne continued as follows:

At this stage permit me to say, Mr. Speaker, that no new contracts for ships have been let since the year 1919. I have noticed from time to time that the press of Canada, and occasionally some gentlemen engaged in banking—the presidents of our large financial institutions—have called upon the Government not to construct any more ships, expressing the opinion that the time had arrived when shipbuilding by the Government in this country ought to cease. I find no fault with these financial gentlemen except to say that when they made such appeals they seemingly were not aware that the Government had not placed any new contracts for the construction of ships since the year 1919, but was simply carrying to completion its original shipbuilding programme. Some of those who made this demand were of the opinion that when the armistice was signed the Canadian Government should not have given any more contracts for ships.

The year 1920, as was generally anticipated, proved unsatisfactory to shipping interests the world over, more especially from the point of view of net earnings. The loss of tonnage that had been sustained during the war was more than overtaken, with the result that there had been throughout the year a surplus of available tonnage. The world tonnage at the commencement of the war was about 49,000,000 tons. The available world tonnage at present is about [illegible] tons.

The costs of operation that had reached abnormally high proportions during the war, and to which reference will be made later, continued throughout the year. That taken in conjunction with the substantial decline in freight rates from those of the previous year added very materially to the difficulties with which shipowners had to cope. During the year there was a very severe decline in freight rates from United Kingdom ports over well defined routes, such as those to India and South America. While the decline in transatlantic rates to United Kingdom ports was not so acute, it was nevertheless very substantial, and had a marked effect on the earnings of vessels. For instance, there has been a decline of 65 per cent. in the rate on flour; on grain 61 per cent.; on deals 55 per cent.; on cereals 48 per cent.; and on apples 41 per cent. On cargoes from Canadian ports to South American ports decreases have averaged from 17 per cent. to 50 per cent. On cargoes to India there has been a decline of 20 per cent. in the comparatively short time since the route was established. From British Columbia ports to Australia there has been a steady decline averaging between 15 per cent. and 35 per cent. On the one article of lumber the decline over the rate for 1919 was, during 1920, at least 25 per cent.

Over all the principal trade routes, both transatlantic and transpacific, there has been a corresponding decline in freight rates, and while shipping companies during that time had to contend with the highest operating costs ever known, they were also faced with the problem of smaller cargo offerings than had been the case for many years. As an indication of the enormous extent to which operating costs have increased in recent years, I would point out that the percentage of increases in the prices paid for the principal requirements as between the years 1914 and 1920 has been approximately as follows:

	Per cent
Coal	133
Provisions	100
Oils, etc.	100
Paints	125
Rope	100
General deck and engine stores	100
Wages	300

So acute is the depression in shipping that for some considerable time there have been lying idle in different ports of the world a very large number of British ships, and at the present time there are lying idle 536 steel steamers of United States registry in addition to nearly 300 wooden vessels of the same registry. Under all these unusual conditions the Canadian Government Merchant Marine may well be considered to have had a very satisfactory year, the results of which I shall place in more detail before the House.

The next matter of interest I wish to bring before the House is the number of ships that the Government own.

There are in commission at the present time 47 vessels of the following types:

16 ships of 8,300 tons each.
8 ships of 5,100 tons each.
8 ships of 4,500 tons each.
12 ships of 3,500 to 3,900 tons each.
3 ships of 2,800 tons each.

of an approximate deadweight tonnage of 259,783 tons.

The entire programme when completed will comprise 63 ships of approximate deadweight tonnage 374,254 tons.

Seven of these vessels are being equipped with oil fuel installation and thirteen of them will be provided with refrigeration spaces.

It will be recalled, Sir, that for the purpose of the shipbuilding programme the sum of $20,000,000 was voted for the present fiscal year. Of that amount there has been expended up to the present $14,684,513.99. It is estimated that before the end of the fiscal year a further amount of $650,000 will be expended, making a total expenditure for the year of $15,334,513.99. It therefore follows that, of the amount of $8,000,000 which will be required to complete the programme, $4,665,496.01 is a revote.

Now I come to the comparative cost of construction. The average cost of constructing all the vessels under the Government shipbuilding programme figures out at $191.95 per deadweight ton. The average cost of the vessels constructed by the United States Shipbuilding Board has been stated in a recent official communication to be about $215.00 per deadweight ton. So that on a much smaller programme our cost compares very favorably indeed with the cost of construction of similar steel vessels by our friends to the south, being nearly $24 per ton less than theirs.

With regard to the costs of operation, it will be found that a comparison of Canadian wage costs with like costs of operating similar ships by Great Britain, the United States, Japan, Norway and France, is as follows:

The monthly wage cost of a Canadian Government Merchant Marine ship of 8,100 tons deadweight, which carries a crew of 41, including 2 boys, is $3,705. Published figures from an authentic source (bulletin issued by Dow, Jones & Co., of New York) show the monthly wage cost of foreign ships of similar tonnage as being, for British ships $3,924; American, $5,315; Norwegian, $3,378; and Japanese, $2,869.

Now, Mr. Speaker, I would like to give the House particulars of the number of officers and men employed on our Government ships at the end of the last

calendar year. All told the number was 1,674, comprising:

Masters	48	
Officers	138	
Engineers	188	
Ordinary seamen, firemen, stewards, etc.	1,305	
Total	1,674	
Total number Canadian by birth or adoption -		
Masters	30	
Officers	77	
Engineers	129	
Ordinary seamen, firemen, stewards, etc.	652	
		868
Total number British		
Masters	18	
Officers	81	
Engineers	54	
Ordinary seamen, firemen, stewards, etc.	653	
		806
Total		1,674

In accordance with the trade agreement concluded during the year with the British West Indies it was decided to equip two of the 5,100-ton vessels then under construction with passenger accommodation, in consequence of which a regular service every three weeks has been established between Canada and the Bahamas, Jamaica and British Honduras. The delegates at the very important conference held in this city in June of last year—I refer to the conference in Ottawa held with a view to negotiating a preferential trade agreement between Canada and the West Indies—particularly the delegates from the Bahamas, Jamaica and British Honduras, claimed that they were very short indeed of passenger services. I informed them, as your Minister of Marine, that the Government did not own or intend to build any passenger ships, but the delegates were very much interested in the matter and continued their pressure upon me and the other representatives of the Government, requesting us to equip if possible some of our freight ships with a liimted passenger accommodation. I pointed out to them that I did not think it would pay to equip freight ships with a limited passenger accommodation and to operate them on such a long route as that of Halifax to the Bahamas, Jamaica and British Honduras and back over the same route in the winter, and from Montreal in the summer. The representatives from the West Indies then said that if it did not pay, the countries they represented would each contribute a certain amount. I am sorry I have not before me the amount that each of the Islands stipulated in the agreement that it would be willing to pay, but if my memory serves me correctly the amount in all would be about £13,000. We cannot tell at the present time whether or not this new route will pay, but judging from one or two voyages that the ships have made, it looks as if it might break even. I would not, however, be prepared to make that as a positive statement; we shall have to wait until the end of the fiscal year. While the accommodation provided is but for twenty-six cabin passengers on each vessel, it is of such an excellent character that it attracts a full passsenger list for each sailing. Full cargoes also have been carried, and it is confidently expected that the regularity and character of the service generally will build up a profitable business in the interchange of the products of these British possessions and Canada. The first vessel on this route sailed from Halifax on January 25 last, with a full complement of passengers and a general cargo of flour, potatoes, oats, cement and general merchandise.

The House and the country generally, and the exporters of Canada in particular, will be interested to know what these ships are capable of doing in the way of expanding Canada's export trade. In this connection, Sir, I regret to have to express my disappointment with the efforts so far made by the Canadian manufacturer and exporter. These ships have been equipped with one or two extra passenger cabins in order that Canadian business men might either go themselves to these British possessions and foreign countries, or send their commercial agents. While the showing of exports is not a bad one so far, I would like again to make an urgent appeal to the manufacturers and business men of Canada to reach out more aggressively for export trade. I said last year, and I say it again, that if Canada is to wipe out her immense war debt within a reasonable time, Canadians must not only look after the home trade but reach out aggressively for foreign markets. We have provided this magnificent fleet of freight ships and these new routes have been opened up. No old-established steamship company would take the chance that the Government ships have taken in opening up one new route after another; these old companies would naturally hesitate and first try to ascertain whether or not it would be profitable to put ships on the various new routes to which I have referred. But these ships are Canadian ships, built in the national interest. The Government has never attempted, and I hope never will attempt, to interfere in the management of these ships; all I have said to the management as the responsible minister was that they should make all the money they could, at the same time keeping the national interest in mind and assisting the Canadian people in every possible way to export the products of fishery, forest, farm, mine and factory. Canadians, therefore, have reason to be proud that they possess this immense fleet of new ships going to all corners of the world, and making a very creditable showing, to which I shall refer in a moment. But the great feature of a Canadian merchant marine is the fact that this country can say: We want this ship, or so many ships, run on whichever route we think there is a possibility of Canada obtaining trade and thus expanding her export business.

I have not arrived at what, I presume, will be the most interesting part of my statement this afternoon, and that is: What results have been obtained from the operation of these ships during the past calendar year?

Operating Account for 1920.

Gross Revenues closed voyages		$10,027,442.77
Operating expenses		8,733,917.22
Operating Profits closed voyages		$ 1,293,525.55
Deduct		
Depreciation	$667,665.46	
Outstanding liabilities	22,000.00	
Incorporation expenses	5,400.00	
		$ 695,065.46
Net earnings closed voyages		$ 598,460.09
Net earnings on voyages closed since January applicable to 1920		183,000.00
Total net earnings		$ 781,460.09

I wish to point out that these net earnings are before providing for interest, and the above amount of net earnings, $781,460.09 is given to the Government for the full costs of the ships.

Canadian Government Merchant Marine Limited and Subsidiary Companies.

Consolidated Balance Sheet as at 31st December, 1920.

Assets

Fixed Assets		
Vessels at cost	$50,005,892.71	
Less deprecia. reserve	815,841.32	
		$49,190,150.39
Plant and equipment at cost	$ 27,243.25	
Office furniture at cost	29,128.66	
	$ 56,371.91	
Less deprecia. reserve	2,818.60	
		53,553.31
Total		$49,243,604.70
Current Assets—		
Cash in banks and on hand		$ 426,816.02
Accounts receivable		1,750,161.36
Advances to captains, crews and agents		54,605.09
Adjusted losses due by underwriters		67,860.82
Insurance claims, estimated amount recoverable		686,805.51
Interest receivable accrued		4,583.33
Inventories of stores and supplies		44,821.84
Dom. of Canada Victory Loan, 1934.		500,000.00
Total		$ 3,535,653.97

Liabilities.

Capital Stock	
Authorized 10,000 shares of $100 each. $1,000,000, issued 4,709 shares of $100 each	$ 470,900.00
Notes payable:—	
Due Dominion Government secured by mortgages on vessels	49,535,892.71
Current Liabilities—	
Accounts payable	1,712,803.03
Open voyages —	
Balances of uncompleted voyages	963,820.65
Surplus	
Contingent liabilities (none ascertained)	1,004,233.01
	$53,687,649.40

As regards current assets, honorable members will, I am sure, note with pleasure the strong liquid position of the operating company. No bank loans are shown, and the operating company is in an easy position financially.

Now I just want to say a word or two in regard to the present outlook. While there is a business reaction throughout the world, I am under the impression that this is only of a transitory character, and that we can look for a considerable improvement in trade in the very near future. While freight rates may be expected to still further decline, this will be offset by much lower operating costs, and with the acquisition of the Grand Trunk Railway system, this additional mileage added to the lines which the Government now own and operate, will make in all 23,000 miles, and will act, I

hope, as a constant feeder to the Government ships.

Now, just a word or two in regard to shipbuilding conditions. Conditions throughout the world are quite similar, owing to the lack of demand for tonnage. Canadian shipbuilders, therefore, are experiencing the same depreciation that is being experienced in other countries. Canadians have demonstrated that they can build ships equally as good and, during the past few years, at as low a cost as the old and experienced yards in the United Kingdom. Freight ships today of 8,400 tons deadweight corresponding to the Government's type would cost in the United Kingdom about £29.10 per ton, equal to $130 at the present rate of exchange. I have had no need to ask Canadian shipbuilders recently for a price to construct steel ships, but I have every reason to believe that the Canadian price would not be any more than $10 or $15 per ton higher than the United Kingdom price which I have just quoted.

As I have already stated, by July next all the Government ships will have been completed and placed in commission, and Canada will have reason to be proud of her merchant marine modern freight ships.

THE MARINE OIL ENGINE

The position of British shipping today, if not positively serious, is, to say the least, causing no small anxiety, and ship owners have got to look around them and find the means whereby they can study conditions and adopt economic methods in order that the shipping industry may survive. Engineers and shipbuilders, who have had long associations with all marine and shipping interests, not only realize the perilous path along which events in the mercantile marine are moving, but they are looking ahead to see which way the path will lead. These men are in a position to advise and assist those who do not perhaps appreciate what the future is likely to bring.

It is becoming painfully obvious to many owners of coal-fired steamships on almost any service to-day that their boats cannot be made to pay working expenses under existing conditions. Even the Diesel-engined ship, with its many economies in working expenses, machinery and bunker space, etc., is probably sailing dangerously near the "no profits" mark. What the owner no doubt wants to learn is the remedy or the means by which he can so economize as to show a reasonable chance of his activities in the shipping industry resulting successfully. Men who have made a study of these factors have no hesitation in singling out the internal combustion engine, using crude or heavy bodied fuels, as the machine which during the next few years is going to save the situation.

The internal combustion engine is, of course, by now a "household word," or whatever is its equivalent in a marine sense; but it is hardly to the machine of the past, that has had to fight its way into the position it holds to-day, that shipbuilding engineers refer.

The ship that is to pay in the future must be fitted with oil engine machinery that will comply with the following conditions:

(1) As reasonably light in weight as solidity in construction will permit.

(2) To accord strictly with Lloyd's and the B. O. T. requirements.

(3) To be able to work satisfactorily and unquestionably on the heavier residual oils up to .93 S.G., without any difficult or complicated adjustments.

(4) To be sufficiently economical in working and capital costs as to bring it within the scope of the owner.

(5) To be simple and accessible in design and construction.

(6) And to embody all these essentials to the marine engineer that marine engineering demands.

There is very strong belief that necessity for economy will give a new lease of life to the sailing vessel, and, since wind is free, owners will incline to this class of ship; but here again we cannot expect such vessels to be on the same lines as in the past. In the internal combustion engine working, a single screw will be a compulsory adjunct to manoeuvre such a vessel in and out of port and help her generally in adverse weather conditions. The propeller will probably be of the feathering blade type, since this is the only method by which the least resistance under sailing conditions can be assured.

Then again, with labor as it stands to-day, the very considerable crew required by a large sailing ship must be reduced to an absolute minimum by means of mechanical rigging, and such a carefully thought out system of sail arrangements as may be simple, but at the same time give the desired cruising speed. The important part that the oil engine has to play has been considered as coming under two distinct headings:

(1) Oil engine machinery to act as main motive power.

(2) Oil engines as auxiliary power.

When oil engines are made to serve as main machinery they are, of course, constructed in the higher powers and are designed especially for tramp vessels, fishing trawlers and tugs. Such engines are cold starting, without the employment of electricity or any electrical gear, and the manoeuvring and other special qualities that each individual industry demands have been carefully thought out and solved in the most efficient manner.

The great waste in the stand-by losses of a steam tug affords perhaps an opportunity for the oil-engined tug to show up to the best advantage, and those interested in the subject would do well to investigate it deeply in order to see exactly the method by which the oil engine is made to serve the purpose and the great saving that its employment effects. The special requirements for the tramp vessel and the trawler have had the critical attention of engine builders in Great Britain, and where the smaller units are concerned their oil engines conform to the general rule for semi-Diesel engines, excepting that they will be found to embody every latest improvement which could possibly tend towards greater reliability, economy or efficiency; and it is this class of engine that is recommended for auxiliary purposes.

TANK STEEL.

Tank steel has been defined by the Association of American Steel Manufacturers "as a grade to be used for ordinary fabrications or for structural purposes where no particular stresses are required. It should be free from "surface defects." The reason for making this definition lies in the fact that, since the outbreak of the war, a great deal of "tank steel" has been specified for purposes for which such steel was unsuited and then has had attached to it requirements that would throw the material into a higher classification without, of course, expecting to pay the extras required by such higher classification.

The ruling of the committee is, further, that if the buyers' specifications stipulate a tensile test from each plate as rolled, the material shall be classified as flange steel. Further, that if a flange steel purchase specifies a homogeneity test in addition to naming chemical and physical properties, the material becomes firebox steel. Again, that if the steel plate order carries specifications with regard to phosphorus and sulphur limits equivalent to the firebox grade, the steel shall be regarded as firebox steel unless the chemical tests are modified.

The Lakeside Bridge & Steel Co., North Milwaukee, Wis., have almost completed arrangements for representation in Canada. The company are manufacturers of steel frame structures and machinery and are general engineers. They will be interested chiefly in selling and manufacturing the Labride coal handling equipment for the Canadian trade.

The Fulton Iron Works Co., St. Louis, U.S.A., have published a handsomely illustrated catalogue describing the Diesel engine manufactured by the firm. The booklet, after describing briefly the origin of the Diesel engine, and its working cycle, together with some curves and tables of fuel consumption, continues with a detailed description of the engine itself, which is well illustrated.

The Salving of the Leonardo Da Vinci*

This Italian Battleship, Sunk By an Explosion While Lying at Her Moorings, Was Salved in a Most Ingenious Manner by the Italian Corps of Naval Constructors.

IN August, 1916, the Italian Dreadnought Leonardo da Vinci, while anchored at Taranto, sustained a terrific explosion in her after magazines. A large rent, over 500 square feet in and extending up both sides, was blown through the hull just forward of the inner propellers and another through the deck. The vessel soon settled down by the stern and ten minutes later she capsized to port and sank in six fathoms of water. In this disaster, which had been engineered by the enemy, 249 officers and men were killed.

The Leonardo da Vinci is a sister ship of the Comte di Cavour and the Guilio Cesare, battleships of 22,380 tons displacement, armed with thirteen 12 in. guns distributed in three triple turrets and two twin turrets, eighteen 4.7 in. guns, and the same number of 3 in. guns. In addition, they have two broadside torpedo tubes and one stern tube. The protection consists of 8 in. to 9¾ in. armour plating amidships. Their speed is 22 knots and propulsion is effected by four screws driven by turbines of 30,000 shaft horse-power. The overall length is 650 ft. The loss of such a valuable ship naturally led to the consideration of her salvage, and a committee of experts was set up to report on the different schemes which were soon proposed and to arrange the special organization required to carry out the work.

The difficulties to be overcome were very great and presented entirely new problems. It was at length decided that the ship should be refloated by means of a floating dock to be constructed especially, but great difficulty was met with in obtaining the necessary materials and men at a time when more urgent war work was taxing the resources of the country. Hence, as it was certain that the ship could not in any case be put back into commission before the end of the war, the work of salvage was not pressed forward. Later on, however, it was taken in hand with renewed vigor, but the original plan was modified, and it was decided to refloat the ship upside down by means of compressed air, to tow her into the existing dry dock at Taranto, and there to repair the damage so that she could subsequently be righted at sea.

For the purpose of carrying out this ambitious programme it was necessary to patch the holes in the sides and to render air-tight a large number of compartments in the ship. This work had to be done under water and proved to be extraordinarily arduous, one diver losing his life in this phase of the operations. The enthusiasm and the determination of the officer in charge, Lieut.-Colonel O. Gianelli, of the Military Corps of Naval Constructors, shared by his staff, was, however, such as to overcome all difficulties, and in the autumn of 1919 the great ship was refloated and towed into the dry dock. The holes permitted the water to fill the magazines and neighboring compartments, while it also obtained access to the two inner shaft tunnels. The lowest apertures in the hull which were open at the time of the explosion were the after port holes, about 37 ft. above the keel. The water entered through them and probably through the gun hoist openings, thereby distributing itself in the ship in such a manner as adversely to affect her stability. The impact caused by the after part of her bottom touching the ground then probably gave her the initial push which led to her capsizement.

By means of large-sized models of the ship, especially constructed, it was, however, ascertained that she would have capsized even in deep water. These models were also used to test the various schemes put forward for the sal-

*The Engineer.

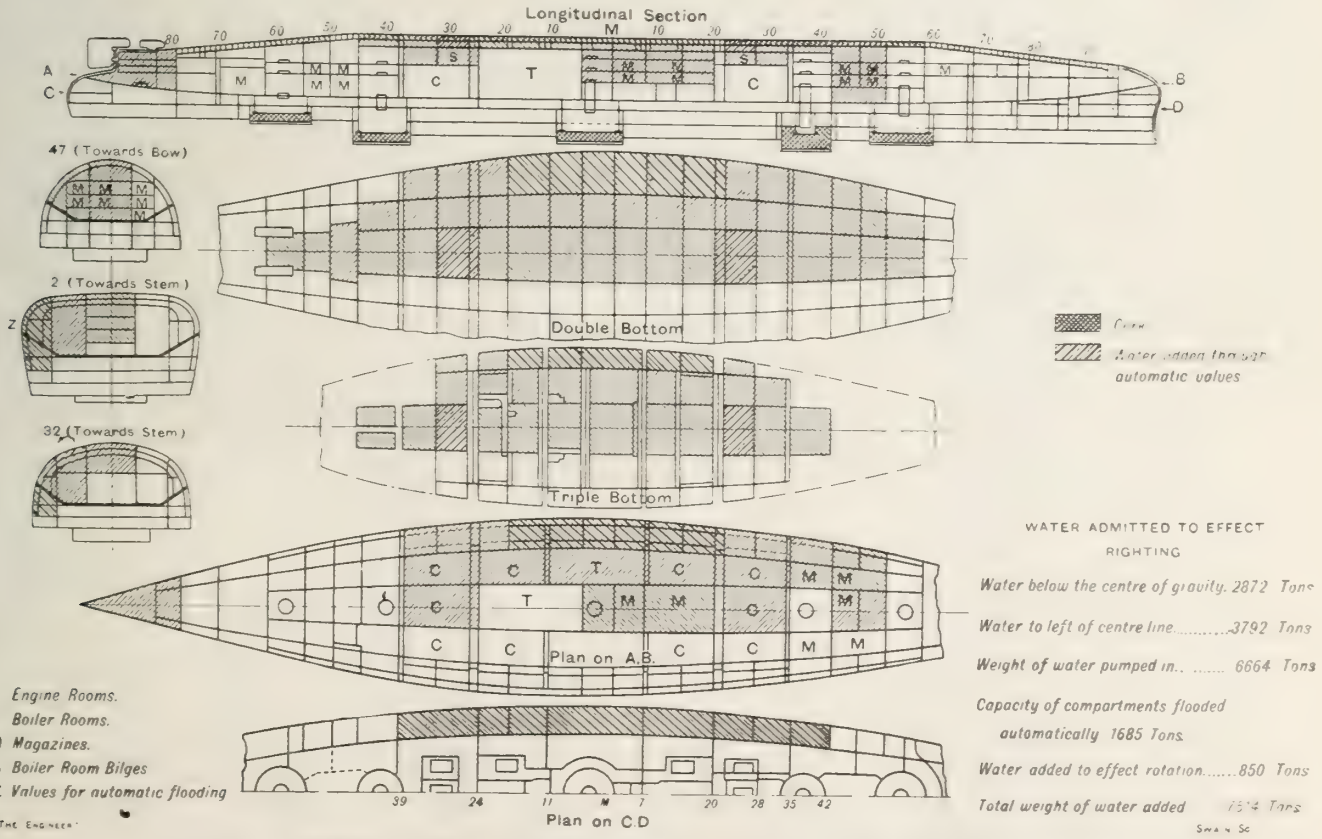

Longitudinal Section
47 (Towards Bow)
2 (Towards Stem)
32 (Towards Stem)
Double Bottom
Triple Bottom
Plan on A.B.
Plan on C.D
Water added through automatic valves
WATER ADMITTED TO EFFECT RIGHTING
Water below the centre of gravity. 2872 Tons
Water to left of centre line.....3792 Tons
Weight of water pumped in..... 6664 Tons
Capacity of compartments flooded automatically 1685 Tons
Water added to effect rotation.....850 Tons
Total weight of water added 7514 Tons
T Engine Rooms.
C Boiler Rooms.
M Magazines.
S Boiler Room Bilges
Z Values for automatic flooding

FIG. 1—DIAGRAM SHOWING COMPARTMENTS FLOODED DURING RIGHTING PROCESS.

vage. Fig. 4 shows the position of the ship one week after the accident, and reveals the fact that a large portion of the port side wall of the hull and practically the whole of the deck was buried in the mud. It was found that the ship was sinking deeper into the mud, but five months later she remained stationary about 6 ft. deeper than is shown in the diagram, Fig. 4, the transversal inclination being then 170 deg.

Accurate data as to the distribution of the weights of the ship's equipment at the time of the explosion were not available, but the indications of the surviving crew and a careful examination of her sister ships enabled the authorities to establish that the mean draught must have been about 30 ft. 6 in. and her displacement 24,000 tons, while her centre of gravity was probably 33 ft. 6 in. above the keel, assuming that boilers and engines had not been displaced. This latter assumption proved to be correct.

THE "LEONARDO DA VINCI" BEFORE THE EXPLOSION.

All calculations regarding the work to be performed were based on the above data. Actual operations did not begin until December, 1916, but in April of the following year it was already possible to pump compressed air into the ship through an air lock especially constructed and applied to one of the rents in the side of the ship. Through this air lock the stern magazines were emptied of their contents and at a later date the magazines forward and amidships were similarly emptied, while the rents in the hull were definitely patched by means of the vaulted structures shown in Figs. 5 and 6. Tap rivets were used for fixing the patches to the hull and the underwater drilling and screwing of the holes in the plates of the hull to correspond exactly with those of the vaulted structures was a tedious and difficult piece of work. Rubber was found to be the most suitable packing. The framework used for securing the drills for this operation, which was, of course, carried out under water, is shown in Fig. 2.

The ammunition recovered consisted of 846 12 in. shells with 3,000 charges, 2,866 4.7 in. shells with 2,700 charges, 3,400 3 in. cartridges, two torpedoes, besides the small-arms ammunition and the torpedo charges, weighing in all about 700 tons. Their removal was successfully accomplished without any casualties.

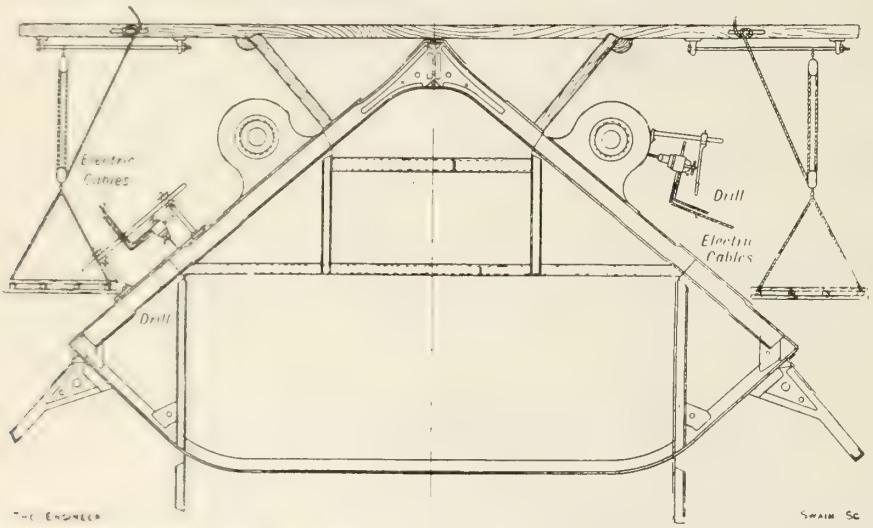


FIG. 4.—SKETCH SHOWING POSITION OF VESSEL ONE WEEK AFTER THE ACCIDENT.

Meanwhile, by means of compressed air, it had been possible to lower the water inside the fore part of the ship to a depth of 26 ft. below the level of the sea. This proved the possibility of refloating the whole ship with compressed air, and the previously mentioned difficulty of obtaining materials for the construction of a large floating dock led to the decision to dispense with that costly adjunct and to alter the programme as indicated above.

However, the dry dock at the Naval Dockyard at Taranto was only 40 ft. deep, and it became necessary to remove all superstructures above the forecastle deck in addition to the turrets and conning towers in order that with her keel still upwards the vessel might be able to enter the dock.

The funnels and the five armoured turrets with their guns had, therefore, to be detached and provisionally left at the bottom of the sea; but, as even that was not sufficient, it was decided also to detach the barbette of the second forward turret, which, being superimposed

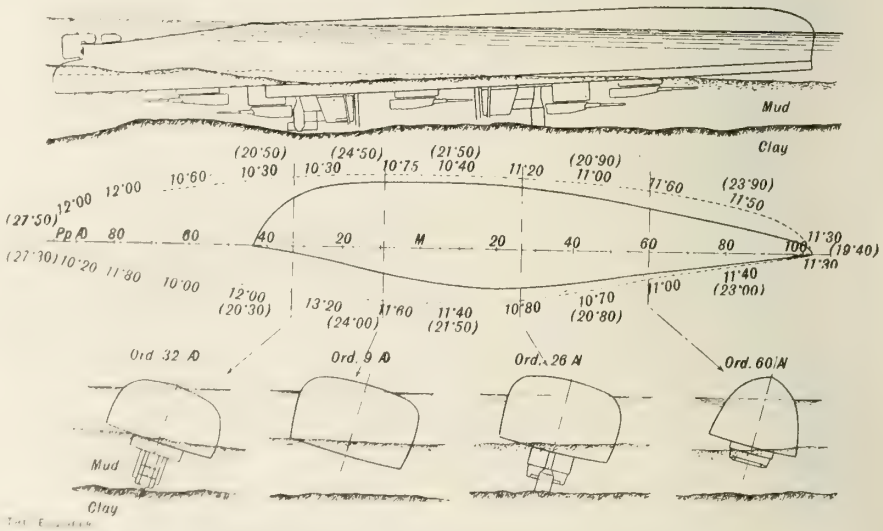


FIG. 2.—ARRANGEMENT FOR DRILLING HOLES IN THE HULL.

on the first forward turret, was at a considerable height above the deck. This was done from the inside of the ship at a depth of 56 ft. below the level of the sea and up to a depth of 20 ft. below the level of the mud. One of the spaces of the ship was, for this purpose, used as a diving bell.

The disconnection of the two funnels was no easy task. In spite of the fact that they had sustained a shearing strain when the vessel capsized, they were found to be still firmly attached to the ship over four-fifths of their circumferences. To detach them it was necessary to operate from the inside of the ship, and the work of disconnecting them from the body required much time, the inner plating and two outer jackets of each entailing work on about 400 ft. of riveting.

Work in the stern part of the ship had also progressed to the extent that, with compressed air it was found possible to lift her clear of the mud experimentally. The next problem to be faced was to obtain sufficient stability to permit of the ship being towed keel up to the dry dock through a distance of about 1½ miles. Experiments were made on one of the models and it was found that she could float with a displacement of 18,000 tons, 6,000 tons having been removed in the shape of superstructures, coal, and ammunition. To ensure transversal stability it was necessary to render perfectly water-tight as far as the upper deck two bulkheads situated the one 35 m. from the centre of the ship towards the bows and the other 39 m. towards the stern, as well as the two longitudinal lateral bulkheads between these two transverse bulkheads.

The anticipated transverse metacentric height in these conditions was 6 ft. 3 in.

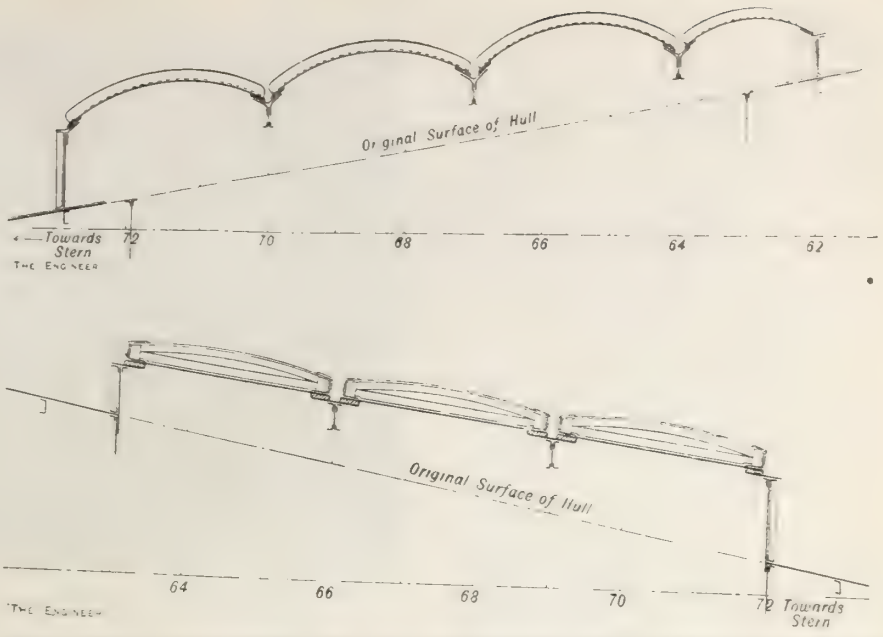


FIG.S 5 AND 6. STRUCTURES USED TO FORM PATCHES FOR CLOSING HOLES IN HULL.

and the longitudinal metacentric height was 725 ft. Should it not have been possible to obtain water-tightness up to the upper deck, but only to the main deck, the metacentric heights would have become negative, viz., transversally 4 ft. and longitudinally 220 ft.

To make sufficient stability quite certain it was decided to apply eight air cylinders of 16 ft. diameter and 70 ft. long, lashing them elastically to the ship by means of wire ropes, four on the port side and four on the starboard side. Each one of these camels would give about 350 tons of buoyancy when submerged. With these cylinders applied at the ends of the ship and level with the anticipated water line the positive metacentric heights were estimated to become 10 ft. transversally and 300 ft. longitudinally. All these calculations proved to be correct, and the ship was successfully floated and towed to the dry dock. During this journey the air compressors carried on lighters were working all the time; they were driven by electric motors supplied with current from the power station on land.

It was necessary to enter the dock bows first in order that the lower stern superstructure should not interfere with the timber chocks which had previously been arranged to take the weight of the ship. The highest had to be 15 ft. high.

The weight of the ship and cylinders —the latter partially filled with water to obtain the exact buoyancy required— was 19,200 tons, giving an average pressure of 98 lb. per square inch on the chocks and the floor of the dock. The greatest pressure was about 225 lb. per square inch.

With the docking of the ship the first part of the operations was completed. Some notion of the difficulties which had to be contended with may be gathered from the fact that all work carried out under water was impeded by the mud and particles of rust floating about in the water, and also by the fact that the explosion and the capsizement had freed a quantity of oil which floated on the water in the ship's spaces, covering everything with a thick asphaltic coating after the water had been lowered; its presence rendered inspection and search for leaks very difficult. This stratum of oil, however, proved to be advantageous, in that it protected exposed iron parts from oxidation. The boiler tubes, in fact, proved on test not to have lost their tensile strength, and it was possible to use the shells for practice firing. Even the charges after reconditioning and drying were used in that way. The cost of the salvage up to

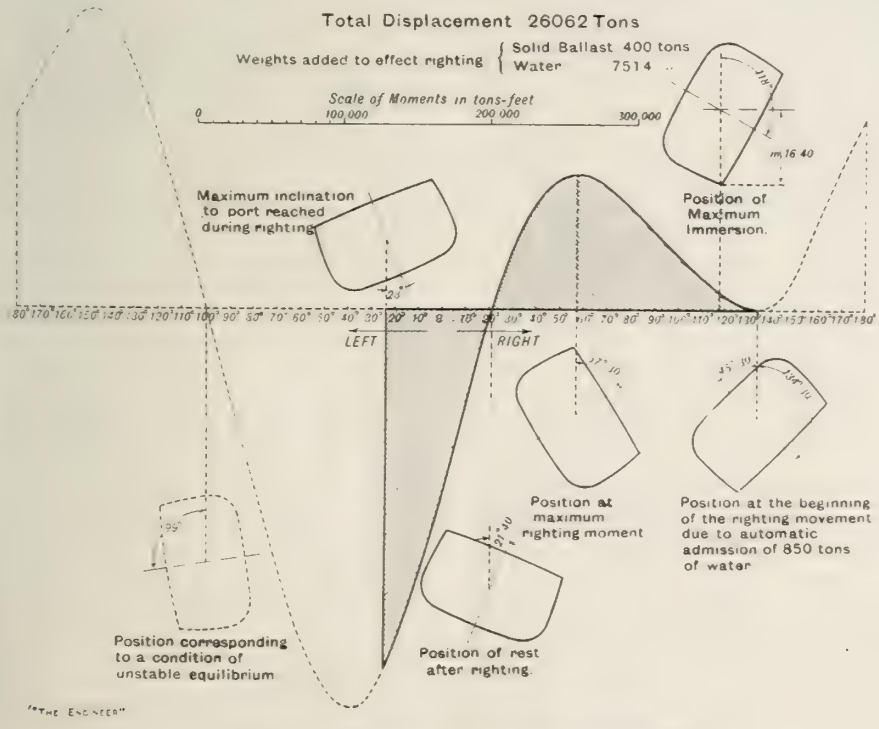

Total Displacement 26062 Tons
Weights added to effect righting { Solid Ballast 400 tons
Water 7514 ..
Scale of Moments in tons-feet
0
100,000
200,000
300,000
Maximum inclination to port reached during righting
Position of Maximum Immersion.
LEFT
RIGHT
Position at maximum righting moment
Position at the beginning of the righting movement due to automatic admission of 850 tons of water
Position corresponding to a condition of unstable equilibrium
Position of rest after righting.
"THE ENGINEER"

FIG. 7—DIAGRAM OF TURNING MOMENTS.

this point was only about £30,000 sterling at the then rate of exchange, although it lasted thirty months, during which 150 men were employed.

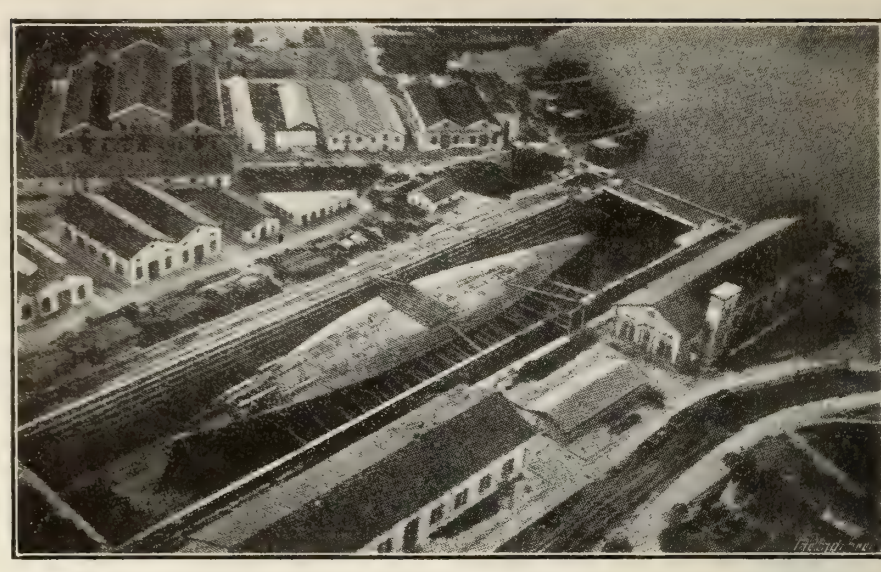
With the ship high and dry it was comparatively an easy matter to inspect her thoroughly and to repair all leaks. The large hole in the deck caused by the explosion was closed, as well as portholes and all the apertures left after the removal of the superstructures which had been detached under water. Since that time six of the thirteen 12 in. guns have been recovered from the bottom of the sea. This work is being done by lowering over them special ring-shaped caissons, to which they are secured and which are subsequently filled with air to make them float.

Particular attention also had to be given to the effectiveness of internal bulkheads, since it was found to be necessary to use some of the compartments of exactly known capacity for filling with water in order to obtain the lateral turning moment required for the righting. In addition, decks had to be strengthened, since they were, of course, originally only calculated to withstand small pressures such as those which might occur when they are flooded whereas when floating keel upwards they would be called upon to deal with much greater hydrostatic pressures.

Fig. 1 shows the compartments which were flooded to obtain the desired conditions. The flooding of the lateral compartments ensured a preliminary list which was to be increased as described later. The central ones were filled to the extent which was necessary to obtain the buoyancy required. The model ship was again used to test and confirm the results arrived at by calculation, and the effects of various possible leakages were ascertained with a view to providing indications as to how possible results should be countered. The stability of the ship was also checked in the dock as soon as she had been refloated. The displacement on the completion of the flooding of the lateral compartments was approximately 25,000 tons.

A basin of adequate depth was excavated in the bay and the ship was towed out to it and suitably secured to buoys The list was then 150 deg. to starboard, and the necessary clockwise rotation when viewed from the stern was obtained by the admission of sea water through sluice valves in the starboard side of the ship. These valves were opened by hand, but the rate at which they allowed the water to enter the lateral compartments with which they communicated was sufficiently slow to allow the operating personnel time to get clear of the ship.

In addition to 400 tons of solid ballast, consisting of pig iron and chains placed in the starboard compartments of the double bottom and treble bottom amidships, the ballast on board, exclusive of the water let in through the valves, consisted of 2,900 tons of water in the central compartments of the double and treble bottoms and in other central spaces such as boiler-room bilges, magazines, and in the compartment at the extreme stern, and 3,800 tons of water in a series of lateral compartments extending over about 260 ft. of the starboard side of the vessel; these latter compartments included one engine-room and several boiler-rooms.



THE "LEONARDO DA VINCI" UPSIDE DOWN IN DRY DOCK.

The capacity of the spaces flooded by the opening of the valves was of 1,700 tons of water, but the gradual entering of 850 tons sufficed to give the ship a list of 135 deg., at which point she began to turn over on her own account. The 5,000 odd tons of water which were thus provided in one side of the vessel naturally gave her a list at the completion of the righting, and this amounted, as foreseen, to 22 deg. to starboard. This inclination was subsequently eliminated by the removal of the ballast used to effect the rotation.

In Fig. 7 the turning moments are shown graphically. The disappearing angle or position of unstable equilibrium at which, if reached, the ship would have turned over again was 99 deg. to port. The 76 deg. of margin between this angle and the maximum list of 23 deg. to port brought about by the momentum of the rotation was, however, more than sufficient to allow for any errors of calculation.

The righting was effected on January 24th last in the presence of numerous spectators especially invited, including the foreign naval attachés. The impressive operation was entirely satisfactory. After the ship had righted herself the Italian flag was automatically hoisted and numerous sirens on the vessel began to blow. Leonardo da Vinci's very appropriate motto, "Ogni torto si dirizza" —every wrong rights itself—had been painted in large letters across the deck whilst the vessel was upside down in dock and was clearly visible from the airship from which the Government's guests witnessed the event.

The salvage of this ship constitutes a most remarkable and unprecedented feat. It is considered in naval circles to be an achievement for which great credit is due to the Italian Admiralty and to the personnel who carried it out undeterred by almost overwhelming difficulties. From the engineering point of view it is also very notable, in so far as it has proved possibilities of compressed air which had not previously been put to the test.

Efforts are being made by the Canadian Workers' Federation of Returned Soldiers and Sailors to hold a mass meeting in Montreal shortly, at which the Hon. C. C. Ballantyne will be asked to preside. At a recent interview with the Minister in Ottawa, a deputation of the workers received his promise to give consideration to the matter of providing work for this class of worker, but could make no definite statement as to the shipbuilding program of the Government. In stating their requests to the Minister it was asked that should contracts be awarded by the Government for the construction of new vessels favorable consideration be given to Montreal as the place of construction.

The Department of Marine and Fisheries announce that the laying of the 500 buoys in the St. Lawrence, between Montreal and Quebec, will be commenced this week; the completion of this work marks the official opening of the river for ocean vessels. While it is expected that cargo vessels now in route may be diverted from their usual winter destination, owing to the earlier opening of inland navigation, it is not anticipated that any great change wll be effected in passenger traffic, as it would be inadvisable to interfere with the prepared

VICTORIA accorded an enthusiastic reception recently to the Pacific Steamship Company's new liner, Wenatchee, when she passed through on her initial voyage to the Orient. The big steamship, although slightly smaller and slower than the Empress liners of the Canadian Pacific Ocean Services, is one of the finest passenger vessels in the Pacific and the largest of the American fleet, now practically monopolized by the Pacific Steamship Company (Admiral Line). The Wenatchee's home port is Seattle, but she will probably make Victoria a regular port of call and among the Oriental centres she will visit are Kobe, Hong Kong, Manila and Shanghai. The length of the Wenatchee, originally built as a troopship by the United States Shipping Board, is 535 feet, and she has accommodation for 260 first-class passengers and 300 third-class, with a crew of 210, and cargo capacity of 5,700 tons. Some notable shipping men were on board the Wenatchee when she sailed, among them being H. F. Alexander and Ancil F. Haines, president and vice-president of the Pacific Steamship Company, and Captain Robert Dollar, head of the Canadian Robert Dollar Company and subsidiary concerns.

* * *

The Pacific liners of the C.P.O.S. have been given a new color scheme similar to that of the company's Atlantic fleet. During the war and up until the present the Oriental liners wore suits of battleship gray, the only differing color being the yellow smokestacks. Now the vessels have red bottoms with a broad strip of green boot-topping the hull's black, a narrow white strip circling the upper parts. The superstructure and lifeboats are snow white.

* * *

Several vessels well known locally were in the thick of the typhoon which recently did extensive damage to Japanese shipping in the vicinity of Yokohama. The Alabama Maru, due to sail on the day of the storm, was riding at anchor in Yokohama harbor. She dragged her anchor and went ashore. The Nippon Yusen Kaisha liner Toyama Maru was also in the typhoon, although the damage is not yet reported. The United States Shipping Board steamer Golden Gate managed to make port in the thick of the storm.

Reports received here indicate that the Australian steamboat employees suffered in the recent shipping strike more than surface indications would show. For a period of one year, or at least until December 31, 1921, the stewards and other union men who went out must remain at work and must obey the dictates of the shipping companies. The men had to pledge themselves to remain peaceably at work. They gained nothing and lost considerable ground, not to mention several weeks' pay. During the strike there were no disorders on the docks. There was some picketing and one or two altercations, but the strikers appeared to be quite willing to await the outcome of their action. The strike had a most dislocating effect on business. The office staffs were in many cases released, although large amounts had to be spent on supplies for the ships while they remained in port.

* * *

The movement of freight from British Columbia ports to the Atlantic coast by way of the Panama Canal is rapidly growing. It is probable that by the end of April 20,000,000 shingles will have been shipped by Canadian Robert Government mercantile marine steamships from British Columbia to Boston, Montreal and other ports. The freight by rail to New York is now $1.25 per hundred pounds, while the water rate is only 75 cents. Because it was $6 a thousand feet cheaper to ship 2,000,000 feet of lumber to Quebec by way of the canal than by rail, the Canadian Government Mercantile Marine, Ltd., decided to bring the steamship Canadian Carrier from the west coast of South America, load her in British Columbia ports, and send the lumber to Quebec by the canal route. The movement of grain through Vancouver is also increasing, and Agent-General F. C. Wade foresees big possibilities. Before the canal was built, British Columbia was nearly 15,000 miles from the United Kingdom. The building of the aqueduct cut this distance practically in half and placed the steamships on an actively competitive basis with the railroads. The grain trade through the canal was stimulated last winter by unusual circumstances. The release of Government control and the break in price induced farmers to hold their stocks for a rise, and by the time they decided to sell, the Great Lakes route was frozen and closed to traffic. The cheapest alternative was to ship by way of the Pacific coast, and now that a precedent has been created and the result has been satisfactory, this trade should continue to grow.

* * *

David Rodgers, Seattle, master shipbuilder, who bossed the famous Skinner & Eddy yards in its record-breaking building program while the United States Shipping Board program was being carried out, is again actively in the ship repair and building business and has organized the Seattle Shipbuilding and Drydock Company.

* * *

The Canadian naval squadron will remain at Esquimalt for an indefinite period. The original order was that the light cruiser Aurora and the destroyers Patrician and Patrick would return to Halifax April 13th, but this has been countermanded.

* * *

Wage differences between the Alaska Packers' Association and the seamen employed in its salmon fishing fleet have been adjusted. About 7,500 employees are affected. According to the agreement, the men will accept a wage of seven cents a fish and an addition of $150 for the trip as against last year's wage of nine cents a fish and $200 for the trip. The agreement ended a controversy of several months' standing.

* * *

That low freight rates to the Orient are bringing back the lumber market within reach of British Columbia export opedators and shippers is the belief of Captain Robert Dollar, veteran head of the Canadian Robert Dollar Company, operating twenty-four steamships and sailing vessels in almost every ocean. Before the war his company was shipping 100,000,000 feet of lumber to China annually, but when the war came freight rates were increased and the market slumped.

* * *

Twenty-five thousand dollars will be spent immediately by the Canadian National Railways in developing the Victoria outer piers built by the Canadian Government for handling the loading of lumber on vessels belonging to the Canadian Government Mercantile Marine and other steamships. It is the proposal of the company to make Victoria

the assembly base for lumber shipments from various mills on the island, which have an annual production of over a billion feet.

* * *

The Hudson's Bay Company has placed orders with the B. C. Marine Shipbuilders & Engineers, Ltd., for four small schooners to be operated on the Mackenzie and Peace Rivers and in the Arctic. The vessels will be completed this summer.

* * *

A petition for the removal of the default decree obtained against the relatives of victims of the Princess Sophia disaster who failed to file their claims at the proper time was presented to the United States Federal Court at Seattle recently by William Martin, attorney for the respondent claimants. Patrick J. Sinott, of Victoria, submitted further claims in respect of several victims. The new application is being made to set aside the order of the court obtained by the Canadian Pacific Railway limiting the time for the filing of claims, on the ground that these claimants were never informed of such an order, which was made in a United States court.

* * *

The new steamer being built for the C. P. R. by the Wallace shipyards in North Vancouver will be launched in August, according to announcement of Captain J. E. Troup, general manager of the B. C. coast service, with headquarters here. The steamer will be in its entirety a product of British Columbia industry, will be able to develop 20 knots, will have palatial fittings, and will be operated on the triangular run between Victoria, Vancouver and Seattle.

* * *

A regular service between Montreal and Vancouver by vessels of the Canadian Government Mercantile Marine, Ltd., has been established and will be maintained by some of the corporation's best steamships, according to the announcement of B. C. Keeley, Pacific coast agent. A full cargo is now awaiting shipment at Vancouver and will be shipped on the first vessel sailing from that port. The service was inaugurated on March 10 by the steamer Canadian Carrier, which sailed from Montreal.

* * *

The steamer Lady Kindersley, launched recently by the B. C. Marine Engineering & Shipbuilding Co., Vancouver, is expected to be the finest ice-fighting freight carrier that has yet taken the water. The little vessel, which is owned by the Hudson's Bay Company, will shortly start on an 11,000-mile voyage through Behring Sea, round Cape Barrow, and through the Arctic summer ice lanes, carrying supplies to the company's trading posts. The steamer was built to resist the pressure of ice floes and the great storms of the north and to carry proportionately large cargoes. She is 200 feet long, 36 feet 3 inches beam, with a moulded depth of 15 feet. Her ribs and hull are of extra strong British Columbia fir, and she is sheathed with two-inch iron-bark planks. She is equipped with sails as well as a semi-Diesel engine. The gross tonnage is only 635.

* * *

According to R. McL. Bolton, formerly accountant for the Canadian Government Mercantile Marine, Ltd., in Sydney, Australia, refrigerated cargoes will probably be the principal mainstay of the company's business with Australia during the next few months. Cargoes from Australia to the United Kingdom are plentiful, he says, but frozen meat is the only commodity being offered in large volume for trans-Pacific transport. The Commonwealth Line, says Mr. Bolton, is making a strong bid for United Kingdom trade, but will not likely create strong competition in the Pacific for the Canadian line.

* * *

Fred C. Finn, local agent for the Chicago, Milwaukee Railway, operating in conjunction with the Osako Shoshen Kaisha in trans-Pacific trade, left for the Orient on the Pacific Steamship Company's new liner Wenatchee's initial passage. He will make a thorough canvass of trade conditions in Japan, China and the Philippines, and prepare a comprehensive report for the company on the possibilities of developing business in the Far East.

* * *

The Dominion Government has reached a satisfactory arrangement with the Canadian Pacific Ocean Services, Ltd., whereby the Canadian liners carry mails across the Pacific to Japan, China, the Philippine Islands and India. For several months, due to the inability of the two parties to work out a satisfactory plan of payment, Japanese vessels operating out of Seattle have been carrying the mails, despite the fact that the Canadian Pacific ships are considerably faster. Completion of the new agreement was welcome news to trade interests on both sides of the ocean.

* * *

The Oriental service that was to have been inaugurated March 26 by the Canadian Government Mercantile Marine has been indefinitely postponed, and the steamship Prospector, which was the first vessel to operate in the new service, has been chartered to carry creosoted railway ties to Egypt for the state railways. The Traveler, which was to be placed in the Oriental run also, has been withdrawn and will carry a similar cargo to Egypt. The steamships will call at India and Oriental ports on their return voyage to British Columbia.

* * *

The summer tourist service of the Canadian Pacific steamers on the Alaska route will be inaugurated June 10. This season the sailings will be maintained by the steamers Princess Alice and Princess Royal, the latter taking the place of the Princess Mary, which last year operated in conjunction with the Princess Alice.

MONTREAL NOTES

ALTHOUGH a record was established this year in the clearing of ice from the River St. Lawrence, the services of the ice-breakers not being required to any extent, it was well towards the middle of the month before the buoys were finally placed, the delay being caused by the heavy winds that prevailed during the early part of April. However, local navigation in the port of Montreal was not affected by the deferred laying of the river buoys, and it is interesting to note that the present season marks the earliest opening in 70 years. The first arrival was on the 29th of March when the Lady Grey came to port after a trip up the river in search of ice. According to the reports of the Harbor Commissioners, the river has not been clear of ice in March since 1850, with the exception of 1878 and 1898, when the ice passed out on March 30 and 31 respectively. Notwithstanding the early opening, the arrival of ocean-going vessels has not been hurried, and the first to dock will have little on the first arrival of last year, when the "Canadian Aviator" docked on April 26th. The first ocean arrival is expected about the 21st.

The Oliver Engineering Co. are removing their Montreal offices and show rooms from 296 St. James Street to 307 St. James Street. This firm has recently installed some large hand operated cranes in the new power plant of the Montreal Harbor Commissioners and also in the plant of the Anglo-Canadian Wire Rope Co.

* * *

A. J. Hopkins, of 392 St. James Street, Montreal, has secured the Canadian agency for the Red Devil dolly jacks, and arrangements have been made for the manufacture of this line in Canada. Mr. Hopkins has likewise obtained the agency for the Billmont tools manufactured by the Edgar C. Guthard Co., of Chicago. This is a line of interchangeable sockets and wrenches.

* * *

In commenting on the employment situation in the port of Montreal, Capt. J. O. Grey, shipping master, said that during the early part of the month there had been a large number of men applying for berths, but he did not think there were more men awaiting the opening of navigation than in previous years. He

so evident in land industries would have much effect in marine circles, and thought that it would be an easy matter to find berths for all men applying.

* * *

What promises to be a thriving venture for the Canadian Government Merchant Marine is that recently inaugurated on the Pacific coast. Officials of the company announce the transfer of the Canadian Rover, Canadian Beaver, and the Canadian Farmer from the Atlantic to the Pacific. These vessels will form the nucleus of a fleet that will ply between the ports of Vancouver and San Francisco, touching at all the principal intermediate points. This route will have a weekly service and it is expected that each vessel will make the round trip every ten days.

* * *

The Montreal office of the Department of Marine and Fisheries has been moved from the old quarters in the Shaughnessy Building to the old Customs House on Common Street, closer to the river front. This building has been reserved for some time past by other Government departments, such as steamboat inspectors, boiler inspectors, live stock inspectors, pilotage and shipping master's office, and it was thought that the Marine Department offices should be located in the same building.

* * *

As the result of an interview between the Hon. C. C. Ballantyne and a delegation of the returned men employed as workmen in the Montreal shipyards, early in the month, the Minister of Marine and Fisheries has consented to attend a meeting arranged for on the 23rd of the month, to discuss the general situation in regard to the shipbuilding industry in this district. The meeting will be held under the auspices of the Canadian Workers' Federation of Returned Soldiers and Sailors, and will be presided over by the president, James McHaffie.

* * *

When the "Canadian Commander" and the "Canadian Leader," the last two vessels built by the Canadian Vickers Company for the Canadian Government Merchant Marine, are turned over to the owners, it is the intention of the latter to place the former on the India and Far East service under the command of Capt. M. Robertson, formerly master of the "Canadian Pioneer." The "Canadian Leader" will be in charge of Capt. J. D. MacKenzie and will make her maiden voyage to Australia and New Zealand by way of the Panama Canal. It is expected that both these vessels will be turned over to the owners before the close of the month.

* * *

W. J. O'Leary, electrical engineer, of Montreal, has developed a new type of electrical motor, based on the utilization of harmonic vibrations for the source of power. The weight of the rotor is about one-sixth that in an ordinary motor of the same horsepower, and it is stated that a saving of from 20 to 50 per cent. is effected in current used. The invention has been patented in twenty-six different countries, and it is claimed that it can be applied to any machine requiring power for its operation.

* * *

An incorporated company to be known as the Prince Edward Island Light, Heat and Power Co. has recently been formed to supply light, heat and power by the use of electricity to all parts of Prince Edward Island, from one large central power station, using coal for generating purposes. It is expected that permanent employment will be provided for about 200 men. Noah A. Timmins, multi-millionaire, and W. J. O'Leary, electrical engineer, both of Montreal, are interested in the company.

* * *

An interesting development is reported by the Marconi Wireless Company of Canada in connection with their experimental station in Montreal. It has been stated that continuous messages are now being received direct from Clifton, Ireland. It is only recently that this achievement has been made possible, due to the progress that has been made in the construction of wireless apparatus. This station was originally erected as a wireless laboratory for the study of static conditions, and it is with considerable satisfaction that the company are now able to announce the receipt of uninterrupted messages over such a great distance. It is believed that it is only a matter of a short time until direct communication will be carried on between Montreal and the Continent.

* * *

Capt. R. O. Jones, who has been in the service of the White-Star Dominion Line for the past 37 years, and who has been sailing to Montreal for 31 years, will retire from active service when the Celtic completes her next trip in May. His first command was on the Vancouver in 1886, and since that time he has had charge of many of the principal vessels of the White-Star Dominion Line, being commodore of the fleet on the Canada for twelve years. Captain Jones has had a wonderful record, being practically free from accidents in the 31 years of his service. He had a large share in the transportation of troops during the past war. He is a direct descendant of Capt. Alexander Jones, the master of the "Mayflower," which arrived with the Pilgrim Fathers at Plymouth in 1620.

* * *

Despite the fact that the Montreal harbor and the entire river has been open for nearly three weeks, no appearance has yet been made of an ocean-going vessel. Just now, however, there is an interesting race on between the Donaldson steamer Cabotia and the Cunard freighter Venusia, and both of these vessels are expected to reach this port about Thursday of this week. The first arrival from the Gulf will be the Manola, of the Canada Steamship Lines, but as the first two mentioned vessels are from overseas, it is one of them that will be in the running for the gold-headed cane that is annually presented to the captain of the first boat arriving from overseas. The harbor is fast taking on her regular summer appearance, but it will be several weeks before operations will be in full swing.

* * *

The engineering firm of G. and J. Weir, of Montreal, have added a new department to their business. This section will take care of the repairing of vessels plying to and from the port of Montreal, and a thoroughly experienced staff of workmen and an efficient superintendent from the parent plant will look after this division of the work. Work on the new foundry of this firm has been started, and it is expected that the plant will be in operation before the middle of the summer. This firm has considerable work booked ahead, and full time operation is looked for throughout the season.

* * *

As a result of the investigation into the stranding of the steamer City of Colombo, which went ashore on the Nova Scotia coast on March 20th, the Commission has suspended the certificate of Captain Robertson for a period of three months. It might be stated, however, that the evidence brought out the fact that there is an uncharted mud bank in this locality, and that it was due to this that the accident happened. It had always been stated that the Nova Scotia coast had been all sandy or hard bottom, and it is known that the New Brunswick coast is muddy, and due to the finding of mud when making soundings, the captain believed he was on the New Brunswick coast, and in making an effort to reach deep water, sailed directly on the shore of the Nova Scotia coast. Capt. L. A. Demers will have this matter investigated by the Department of Marine and if it is found that the chart is inaccurate, steps will be made to rectify it, as this would be a great danger to navigation.

* * *

With the passing of winter construction work has again started on the large cold storage plant being erected at the port of Montreal by the Harbor Commissioners. It is expected that the structure will be sufficiently advanced this summer to enable the lower floor and basement to be used for the handling of perishable goods before the closing of the 1921 season. Work on the power house for operating the refrigerating equipment, and the transforming of power for use on the electrified railroads of the port, has proceeded throughout the winter, and this will be ready for operation in a very short time. An immediate start is to be made on continuing the work of electrifying the remainder of the harbor service, and it is hoped that this will be finished by fall.

At a meeting recently held in the offices of the Shipping Federation an agreement was signed between that body and the Syndicated Longshoremen's Association whereby the men will accept a wage reduction of 16 per cent. on the day rate that was in force last season, and also a corresponding drop on the night work wage. The new rate will range from 60 cents per hour in the day time for handling general cargo to 90 cents after midnight. The rate for grain handlers will range from 75 cents for day work and $1.12½ from midnight on. The working day will be ten hours and double time will be paid for Sunday work. Personal contracts will be made out by each workman, and to assure good faith on all sides it has been arranged that both parties to the agreement, the companies and the longshoremen, will deposit a sum of $2,000 with an incorporated trust company or other reliable party. The new agreement was signed by the officials of the longshoremen's organization and officers of the various shipping firms in Montreal.

* * *

On Saturday, April 9, the first launching of the season took place from the yards of the Canadian Vickers Company at Montreal, when the 6,400-ton Norwegian freighter "Idefjord" was placed in the water. This vessel is 365 feet long with a beam of 49½ feet, with a loaded draft of 23 feet 9 inches. This was the earliest launching in the history of this company, this being made possible owing to the early breaking up of the ice in the River St. Lawrence. The ceremony of christening was performed by Mrs. Magnus Swenson, wife of the president of the Norwegian American Line's agency in New York, for which the vessel was constructed. A sister ship of the same tonnage is now on the stocks and will be launched in the course of a few weeks. In commenting on the activities of this plant at the reception that followed the launching, P. L. Miller, of the Canadian Vickers Company, stated that no further construction work was on the books, and it was thought that as soon as these two vessels were completed it would be necessary to close the plant for an indefinite period. Mr. Miller stated that it was largely a question of labor, as owing to the high wages now paid it was not possible to compete with yards in other countries in the building of steel vessels. If the workmen, in conjunction with the shipbuilders, would consent to accept less profits than they had during the war, Mr. Miller thought some arrangement could be made to keep the yards busy, but that under the present circumstances this would not be practicable. "We hope, however," said Mr. Miller, "that we shall again be doing business at a profit when these stormy days are over, possibly in three or four years." Other speakers were Magnus Swenson, M. P. Fennel, of the harbor commissioners, and L. Aubert, the Norwegian consul at Montreal.

News from Port of Sorel

The first boats to leave the port of Sorel in 1921 were the "Ethel" and the "Mathilda" of the Sincennes-McNaughton Lines, which were sent to Montreal to assist a launching at Vickers.

* * *

Other Sincennes-McNaughton tugs to leave our port are the "Macsin," with two barges for the lakes, and the "Muscallonge" in the same direction, the "Spray" for Three Rivers, the "Pratt" for her usual work in the port of Montreal and the "Emma L." for work in the canals.

* * *

Steamer "Terrebonne" began her season as a freight and passenger boat between Montreal and Beloeil, on the Richelieu River, April 3. She runs on the same schedule as last year.

* * *

Your correspondent was invited on a nice trip up the Richelieu on board the "Francois C." April 5. This is the first time an excursion has been made on the Richelieu River at such an early date in fifty years. The owner was celebrating the lengthening and improvements made to his boat, which is used as a ferry between Sorel and Berthier. As this boat has been repaired at the Government Shipyard, Sorel, the officers and staff were invited and about twenty took the trip. In this connection, it will please travellers from Ontario and west of Montreal to learn that this boat is scheduled to run in accordance with the C.P.R. trains and auto-busses, so one can leave Sorel for the north shore and connect with the C.P.R. or with the busses for Montreal and vice versa.

* * *

I have not been told what was done to the engines of the "Francois C," but Inspector Hamelin advised me that this boat will give a better service than even was expected. Last year she made the trip between Sorel and Berthier in 50 minutes and this year she makes the distance in 35 minutes. In the past she could only carry four atuomobiles and now she is good for twelve. She makes four trips daily and six on Saturdays.

* * *

The Transportation & Shipping Co., Ltd., whose office is 99 Dalhousie Street, Quebec, and whose works are at Sorel, Que., are remodelling Trawlers 16 and 17, which will be turned into tugs for sea service. These tugs were brought to the Government Shipyard sheer-legs and their boilers lifted and brought forward so as to make room for cross bunkers behind the boilers. These new tugs will be under steam around the end of June. They are 133 feet long.

Other information from the Transportation & Shipping Co. is that they have let out a contract with Jos. Gallien, contractor, for a building 200 feet by 50 feet on the western side of the Richelieu to be used as a mold loft. The business will receive a new impetus under the management of Jos. Simard, who tells me that they will go right into the business of building steel and wooden ships, hull, boiler and machinery repairs, also wrecking and salvage outfits. They already operate a fleet of river and sea-going tugs and barges and have cargo boats for sale. Mr. Simard was kind enough to take me all around the works and I am sure all visitors will be welcome.

* * *

The "Ralph T. Holcomb" was put in the water on the 18th inst. She has undergone extensive repairs and improvements at Manseau's Shipyard.

* * *

The port of Sorel has taken a new importance with the Government, as the Inland Revenue, which was formerly an office of the St. Hyacinthe branch of that service, has been merged with the Customs Service at Sorel, and this department is now called Customs and Inland Revenue Department. H. O. Gauthier has charge with A. Paulhus and Alfred Francoeur, the latter having formerly been the revenue agent.

BURNING FUEL OIL

Set the burners open wide,
Do not touch the valves at side;
Keep the pressure on the pump,
And up the bally steam will jump;
If the smoke is black and thick,
Open up the fans a bit;
If the smoke is thick and white,
To slow the fans will be quite right;
For when sufficient air is given,
No smoke ascendeth up to heaven.
If the jets refuse to squirt,
Assume the cause is due to dirt.
Should the flame be short and white,
You have combustion clear and bright;
But should the flame be yellow and long,
Combustion is entirely wrong.
A wise man to his heater sees,
And keeps it 200 degrees;
To have it more is not quite wise,
Because the oil may carbonize;
A little lower has been found
To give as good results all round.
If the filters are kept clean,
No rise in pressure will be seen;
But should the pump kick up a ruction,
There's likely air within the suction.
The pressure governs the supply,
So do not keep it very high.
If these instructions you will follow,
You'll beat the other fellow hollow.

Extract from "Marine Engineering Knowledge," W. C. MacGibbon.

LAUNCH OF THE "CANADIAN COASTER"

The Canadian Government Merchant Marine steamer "Canadian Coaster" was launched from the yard of the Collingwood Shipbuilding Co. at Kingston. The christening ceremony was performed by the niece of the manager of the yard, Miss Nettie Kay. H. C. Welch, the manager of the yard, also celebrated the twenty-fifth anniversary of his wedding, so it was a really great occasion.

The "Canadian Coaster" has been built especially for the requirements of the West Indian trade. She was in a very advanced stage of completion when she was launched, the boilers and engines being installed and the interior work generally well ahead, so that she will soon be ready for her trials.

LAUNCHING THE "CANADIAN COASTER."

The dimensions of the "Canadian Coaster" are: Length, B.P., 251 feet; breadth, moulded, 43 feet 6 inches; depth, moulded, 26 feet. The engine is of the triple expansion inverted condensing type 18, 30 and 50 by 36, to which steam is supplied by two Scotch boilers 14 feet diameter by 10 feet 9 inches with a working pressure of 180 pounds, fitted with the Howden forced draft system. The boilers and engine were supplied by the Collingwood plant of the company.

Among the guests present were H. B. Smith, president, and J. S. Leitch, managing director of the company; Capt. J. B. Foote, representing the underwriters, and R. Pemberton, representing the Department of Marine, and E. R. McMillan, of the British Corporation for the Survey and Registry of Shipping.

The workmanship on the "Canadian Coaster" is of a very high order and reflects great credit on H. C. Welch, manager of the yard, and his staff.

BRITISH BUILDING

The large steel screw steamer "P.L.M. 20," which Sir Raylton Dixon & Co., Ltd., Cleveland Dockyard, Middlesbrough, have constructed for La Compagnie des Chemins de Fer de Paris a Lyon et a la Mediterranee, whose shipping business is managed by their subsidiary company, La Societe Nationale d'Affretements, has recently undergone satisfactory official trials, a speed of 11¾ knots having been obtained over the measured mile with the vessel in ballast draft and a mean of over 11½ knots with 7,500 tons deadweight on board.

The vessel has been built to a very high-class specification, having been specially designed by Captain Veyrat, a director and chief superintendent of La Societe National d'Affretements, to fulfil the requirements of the owners' particular trade. Her principal dimensions are 400 by 56 by 31 feet molded with a deadweight carrying capacity of about 8,900 tons on a light draft of water, and she has been constructed under special survey to receive Lloyd's highest classification, also to meet the requirements of French law.

The steamer is a single deck vessel of the builders' well-known cantilever framed type which has proved so successful for the coal and other bulk cargo trades. This system of construction renders the ship a complete self-trimmer and gives the steamer greatly increased water-ballast capacity, which in this ship is about 3,500 tons, thus enabling the vessel to make satisfactory voyages under light conditions.

Captain's accommodation is provided in a large house on lower bridge with wireless room and chart house on top. Saloon and officers' accommodation is located in house on bridge deck amidships, while engineers' and petty officers' accommodation will be found in houses on poop deck at casing sides. The crew is berthed in poop 'tween decks.

The vessel has 4 large self-trimming holds, which are absolutely clear of any beams, pillars or other obstructions whatever, and cross bunker. The 7 large hatches are fitted with Hogg-Carr patent hinged steel covers, and the steamer has two masts at each of which are fitted 2 Cyclops winches and 2 derricks for raising and lowering these hatch covers, everything being specially designed with a view to the vessel being loaded and discharged by means of grabs.

Wireless apparatus is installed and the ship has 2 lifeboats with Welin's davits, 2 dinghies, electric light throughout, also electric bell installation with fans in cabins, electric whistle, Morse lamp and semaphore. There is also a heavy steam warping winch aft together with steam capstan and steam windlass by Clarke, Chapman & Co. as well as Wilson-Pirrie steering gear by Donkin & Co. with telemotor control and a special mechanical system of ventilation in crew's quarters and in engine room. All equipment is one grade above Lloyd's rules.

Water-ballast is carried in cellular double bottom, aft peak and two large fore peak tanks as well as in the topside tanks.

Quadruple expansion engines, placed aft, having cylinders 23, 32½, 47 and 68 by 48 stroke, supplied with steam by three large single ended boilers working at 220 pounds pressure, having Howden's system of forced draught, have been fitted in the vessel by the North Eastern Marine Eng. Co., Ltd., Wallsend-on-Tyne.

The ship and her machinery have been constructed under the superintendence of Monsieur Marechal and Captain Veyrat of La Societe Nationale d'Affretements and Mr. Reginald J. Eyres, of Messrs. Eyres and Bryers, Newcastle-on-Tyne, Sunderland and Marseilles.

* * *

On Tuesday, 22nd March, 1921, Sir Raylton Dixon & Co., Ltd., launched from their Cleveland Dockyard, Middlesbrough, a fine steel screw steamer which they are constructing for La Societe Generale de Transports Maritimes a Vapeur, Marseilles.

The vessel is being built to a very complete specification and is of the two-deck type with bridge and poop combined and forecastle, her principal dimensions being 370 by 53 by 28 feet 6 inches, molded with a deadweight carrying capacity of about 7,800 tons on a light draft of water and she is being constructed under special survey to receive Lloyd's highest classification, also to meet the requirements of French law including fire extinguishing.

Captain's accommodation will be provided on the lower bridge with wireless office and room together with chart room and wheel house above. Saloon house will be built at fore end of bridge together with accommodation for officers and stewards, while engineers will be housed at casing side on the port side and the petty officers on the starboard side, the crew being berthed under poop

(Continued on page 39)

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Mr. Ballantyne's Statement

THE Minister of Marine has had an opportunity of presenting the case for the Canadian Government Merchant Marine to Parliament, when he made his annual statement on the year's working of the fleet. The minister was very proud of the fleet, and very optimistic for the future. This is as would be expected, and on the result of actual operations, the showing was good. The vessels performed their voyages and showed a profit, and this was also to be expected, in view of the careful management that has been a feature of the fleet since its inception. However, when it comes to a question of paying interest on the investment made by the public in these ships, we are up another tree. They have not begun to pay for this. There is very little likelihood of the fleet making an operating profit in the next year of their operation, and the question arises, as to whether the fleet is a good enough investment for Canada even if it does not pay its fixed charges, or even clear its operating expenses.

It is claimed that the vessels have a certain advertising value, and this is no doubt true, but a $60,000,000 advertising appropriation is a pretty large item. The opening up of trade routes for the Canadian manufacturer is also mentioned as a good reason for the fleet's continued existence. We wonder to what extent the Canadian manufacturer is availing himself of these new trade routes to push export business. With the acquisition of the Grand Trunk by the government there will be another feeder for the government fleet, which should be a help to them. The fact remains that as a business proposition the fleet is very unlikely to be able to earn anything on the investment placed in them. The thing for the Canadian Government and the Canadian public to consider is whether the ships are worth keeping as pioneers of Canadian trade and advertisers of Canada's position in the world, at a large annual expense to the country in addition to that already incurred; whether in order to give them a chance a large portion of the construction cost should be written off, and their value placed at the current value of ships of their class, which is much below the cost; or whether they should be sold to private owners at the best price that can be got when the demand occurs, and the country cut its losses and go out of the shipowning business.

It must be remembered that while railway rates can be boosted up to the skies by an order of the railway board, and shippers have to pay the rates if they want to ship their goods, marine freight rates are governed wholly and solely by competition, and the cheapest freight gets the business. The ship that can be run for the least possible expense is therefore the one that can keep the trade. We do not consider it good business for a government to run a fleet of ships at a loss in competition with private owners who must pay dividends if they want to live.

More Trouble Coming

AT the opening of the navigation season there comes word from New York that on May 1st all the men on the ocean going and lake service craft of the United States marine will go out on strike as a protest against the proposed reduction of wages. There is time of course between now and then for a change of heart to take place, and amicable negotiation to be used instead of force. It is to be fervently hoped that such will be the case. Although strictly speaking it is not our affair, yet we could not help being affected by such a strike, and apart altogether from any inconvenience we might feel, the general effect cannot help but be detrimental to commerce, at a time when there are enough natural obstacles to be overcome without adding artificial ones.

There have been abnormal increases of wages in all branches of trade in the last few years, and the merchant marine, especially in the United States, has not been left out, and in fact, has been favored with very large increases. It makes some of us old deep sea men open our eyes and wonder when we read of stewards getting $160 per month, besides overtime and other privileges. This was all very well when the only concomitant to a ship making a profit was her ability to make the voyage, but in the readjustment that is taking place, it could not be expected to last. The proposed decreases do not seem to be excessive, somewhere in the neighborhood of 10 per cent., which does not represent the amount that wages have been increased by a very large percentage. However, the men seem to have become imbued with the spirit of what we have we'll hold, and are not amenable to argument. There is no doubt, and the seagoing and shoregoing maritime tradesmen will have to finally admit it, that the state of shipping is such that there can be no temporising with the question of reducing costs. The United States sailor is better off than any other merchant marine seamen in the world, and can better afford to accept a cut than most. We do not see where he has any alternative, unless the paternal government once more comes to his aid, and pays for his extra wages by taking it out of the wages of the other branches of the community.

News of The Shipping World

AT THE time of writing Great Britain is again in the throes of a great coal strike, and although it is apparently not turning out as seriously as was at first probable, it is bad enough. The failure of the two great sister unions, the Railway and Transport workers, to back up the miners, has been a great disappointment to the latter, and has diminished the evil effects that would have ensued in a general stoppage of work. The strike was apparently timed to come at the same time as the Government relinquished control of the coal trade. Throughout the war the Government ran the coal mines and wages were kept up by the simple expedient of making paying mines help out those that did not pay so well. The miners at the same time adopted a deliberate policy of delivering the least possible work for the highest possible wages. In putting the mines back under control of their owners it was inevitable that the loose and unbusinesslike ways which obtained under Government control had to cease. Coal had got to such a price that the export market had been practically lost, and domestic industry was being seriously handicapped. A reduction of wages was absolutely necessary, but the fact remains that the reduction would not be so great if the men would have worked at their highest efficiency. Unfortunately a great many of the miners have apparently given up all idea of working at their best, and encouraged no doubt by the ease with which they had held up the Government on previous occasions declared a strike on the basis of a demand for the pooling of all collieries so as to keep wages at their high limit. The Government has showed unexpected firmness, and the older heads in the other unions having apparently prevailed over the extremist advice of the militant section it looks as though the miners will have to give up their scheme of nationalization. Public opinion, judging by the comments in the British press, is dead against them, and there seem to be hopes that a permanent settlement will be arrived at this time, which will allow industry to get under way on a firm basis. It is only in this way that Great Britain can resume her industrial position with regard to the rest of the world. Once more it is emphasized that it is not so much a matter of wages as a matter of delivering an amount of work commensurate with the wages paid.

* * *

THE condition of shipping in the United States is still in an interesting state. The United States Shipping Board, which has earned so much notoriety of late, is still in existence, but whether it will remain so or not is a matter of doubt. There is a considerable difference of opinion, and it is probable that President Harding will make some statement before long on the matter. In the meantime the redoubtable Admiral Benson is still in command. We imagine he is not enjoying the position as much as he once did. The American merchant fleet is anything but an asset to the American public, and we imagine when the actual cost eventually dawns on the electors of the inland community there will be a loud and prolonged howl.

* * *

SPEAKING of the American Merchant Marine naturally brings us to a consideration of our own fleet. The year's operations have been having an airing in Parliament, and Mr. Ballantyne, the Minister of Marine, has been congratulating himself on having a profit of about $750,000. This is more imaginary than real, as it represents a profit without taking into account the interest on investment. While the C. G. M. M. has been well managed and well looked after generally, it is a practical impossibility for it to show a profit on its capital at the present rate of freights, and in common with other steamship owners it has had several ships lying idle for a considerable period. It is quite likely that the past year's operations will prove the most profitable for some time to come, and some means of writing down the capital cost will have to be resorted to, or the ships sold to private ownership and the loss written off.

* * *

SPEAKING at the launching of the Norwegian steamer "Idjeford" from Vickers' yard at Montreal recently the manager remarked that after the steamer still on the stocks was launched there would be no further contracts forthcoming unless building costs were materially reduced. There would be probably no alternative but to close the works down for three or four years till conditions became more favorable. The chief cost, of course, is labor, and there does not seem much disposition on the part of the men engaged in the shipbuilding trades to accept less remuneration if we are to judge by Toronto. Mr. Ballantyne, in the course of his speech in Parliament on the C. G. M. M., said that he did not think that the cost of building in Canada would be more than $10 to $15 per ton more than that in Great Britain. This perhaps does not sound much, but on a 5,000-ton ship it means a difference of $50,000 to $75,000, which is a respectable amount, while on a 10,000-ton vessel it means $100,000 to $150,000. The earnings must be considerably higher to counteract this excessive capital cost, and in these days of decreasing freights and increasing competition it is doubtful where the extra earnings are to come from.

* * *

THE East Asiatic Company, of Copenhagen, have had a vessel built at Ramage and Ferguson's, Leith, which will serve the purpose of training officers for the company's fleet. The vessel is a five-masted sailing ship, and is fitted with a 600 h.p. auxiliary Diesel. She is square rigged and her masts are 160 feet high, while her lower yards have a span of 90 feet. Her canvas contains 56,000 square feet of American cotton. She is 320 feet long, 40 feet beam, and 28 feet 7 inches moulded depth. Who says the day of the sailing ship is over?

* * *

MR. JOHN NESBITT, chief engineer of the steamer "Bayfield," and for 35 years on the Hydrographic Survey of the Great Lakes, is retiring from the active list. Mr. Nesbitt handed over the vessel to his successor, Mr. Gaugoux, recently. The "Bayfield" will, it is understood be again fitted out for salt water service.

During Mr. Nesbitt's service he was engaged on the survey of the Georgian Bay, Lake Huron and Lake Superior. The "Bayfield" was taken down to Halifax during the war, and Mr. Nesbitt, of course, went with her. She was used for a time patrolling and later as a pilot boat, and last year was brought up the Lakes again for survey work on Lake Superior. The survey of the lakes is now practically completed, the remaining work being capable of being handled by motor launches.

* * *

AN interesting case has been recently ended in the Courts of Justice of the Old Country and had to do with that old offence of casting away a vessel, which usually in British courts is so severely punished. This case was no exception. It was concerned with two vessels, the "Dorothy Talbot" and the "Glendalough," and the owners, Jones and Rees, who were charged with having conspired together with Captain Plummer and Hall to cast away these vessels and defraud the underwriters. There were several charges, but eventually the case was narrowed down to a charge of conspiring to cast away the "Dorothy Talbot" and inciting the captain to assist in the crime.

Jones was described as a young man of unusual ability, while Rees was held as having been under the sway of Jones. The charge against the other two defendants was dismissed, there being no clear evidence that they had assisted in the plan. The owners, Jones and Rees, were condemned largely on the evidence of letters written by themselves. Jones was sentenced to two years' hard labor and Rees to nine months.

Enquiries into Marine Disasters

RE S.S. "IMPOCO"

IN the matter of a formal investigation into the stranding and loss of the S.S. "Impoco" at 6.36 a.m., April 5, 1921, on Blonde Rock, coast of Nova Scotia, held in the Court House, Halifax, N.S., on the 13th April, 1921, before Captain L. A. Demers, F.R.S.A., Dominion Wreck Commissioner, assisted by Capt. Neil Hall and Capt. T. R. Coffin, acting as Nautical Assessors.

Mr. W. C. Macdonald appeared on behalf of the owners, the Imperial Oil Co., Ltd., whilst Mr. L. A. Forsyth represented the master.

The following witnesses were examined: Captain Waldo Smeltzer, Charles Edward Pope, first officer; Wm. Groves, wheelsman, and Lorne Dauphinee, second officer.

Report

The S.S. "Impoco" is a steel vessel, single screw, built in 1903, Official No. 135,238, of Sarnia, of 1,383 tons net and 2,256 tons gross, carrying a crew of 26, including three deck officers and three engineers, her length being 250 feet, beam 43 feet 9 inches, drawing 15 feet forward and 17 feet aft at the time of the casualty. The engines were triple expansion type, with a speed of 9 knots.

At 1.35 p.m., April 4, 1921, the vessel left Halifax, N.S., weather conditions being very favorable. The "Impoco" was supplied with standard and steering compasses, which had been adjusted in New York in 1920, and a maximum of but 4 degrees was found. Observations were taken when possible and a deviation book was kept, though it was not produced in Court.

Relying on his compass, also on weather conditions, the master had shaped and plotted several courses which were proper. Between 4.25 and 5.05 a.m. on the 5th April a compass course was given N 75 W, then from 5.05 a.m. until 6.36 a.m.—time of stranding—a compass course of N 65 W had been given. The master was on his settee in the chart room, the weather being fine, hardly any wind, no sea or swell, and horizon perfectly clear.

The first officer, Charles Pope, was on duty and had been told to report the sighting of the buoy off Blonde Rock. When the ship struck the master immediately came on the bridge, ordered the engines full speed astern, at the same time directing sounding operations, which showed that the ship was making water. In fact, the evidence is to the effect that he took all available and possible means to release the ship.

The mate testified that he was wide awake and watching for the buoy as well as the steering, and found on two occasions that the ship was off her course one point. He remonstrated with the wheelsman, but left the quartermaster to compensate by steering more to the southward or rather to port. He had not taken into consideration the time of tide and its possible effect. He only took one bearing off Seal Island light, which could not possibly give him a position. He admitted that he neglected to call the master as instructed. He was looking for the buoy, but only on the starboard side. He had used the marine glasses,—this was corroborated by the wheelsman. After the distance which had been run which would bring him in a position to see the buoy, failing this, even at a mile, why did he not take cross bearings or a four point bearing, and also call the master as instructed?

Whilst it was said during the investigation that Blonde Rock buoy could be seen at four miles distant the Court will, and does, accept this as an exaggeration. In such clear weather the buoy could be discerned easily at 1½ miles, with naked eye, and in ample time to take measures of precaution.

It is evident that a very indifferent lookout was kept by the first officer. With the evidence of bad steering any alert officer would have been suspicious as to his expectations to find the buoy at the bearing the chart showed when the final course was plotted down.

That the ship was well found in every respect was testified to.

No further light was thrown on this matter by other witnesses, hence the Court arrives at the following conclusion:

Finding

The Court having carefully weighed the evidence adduced, finds that the master, Waldo Robert Smeltzer, Certificate No. 4232, had, in view of the weather conditions existing, plotted down and given a proper course which, with steering and attention, would have cleared the vessel of all outstanding danger,—Blonde Rock; also that upon coming on the bridge at the time the ship touched, and after, used proper and necessary means to get his ship out of her dangerous position; but to no avail.

He is therefore exonerated from all blame.

The loss of the S.S. "Impoco" was due solely to the default of the chief officer, Charles Edward Pope, Newfoundland Certificate No. 421.

The following are the reasons upon which the Court has based itself in arriving at this decision:

First—He failed to properly supervise the steering, which, in the Court's point of view, was carelessly executed.

Second—To make himself acquainted with the stage of the tide and its possible influence.

Third—For not calling the master as he was instructed to do.

Fourth—For not taking proper bearings of the objects in view.

Fifth—For lack of proper and efficient lookout.

The Court cannot detect from the evidence that there was wilfulness in bringing about the loss of the "Impoco."

In viw of the above the Court finds Charles Edward Pope, Certificate No. 421, in default and solely to blame, and therefore suspends his certificate for a period of twelve months from April 13, 1921, to April 12th, 1922.

Read in open court at Halifax, N.S., this 13th day of April, 1921.

(Signed) L. A. DEMERS,
Dominion Wreck Commissioner.

We concur.
(Signed) NEIL HALL,
(Signed) T. R. COFFIN,
Nautical Assessors.

RE SS. "ONTARIO NO. 2."

In the matter of a formal investigation held at Cobourg town hall, Cobourg, Ontario, on March 17th and 18th, 1921, before Captain L. A. Demers, F.R.S.A., Dominion wreck commissioner, assisted by Captain James B. Foote and Captain Geo. D. Frewer, acting as nautical assessors, into the causes which led to the stranding of the SS. "Ontario No. 2" some seven miles west of Cobourg, Ontario, on the 23rd January, 1921.

Mr. Frank M. Field, K.C., represented the master, and Mr. W. H. Smith, manager, was present on behalf of the owners.

The following witnesses were examined: Captain F. D. Forrest, First Officer Walter Kirk, Allan Adamson, watchman; J. A. Nicoll, chief engineer; W. W. Curry, second engineer; Bruce Peebles, wheelsman; Captain McCaig and First Officer H. Matthews, of the SS. "Ontario No. 1."

The SS. "Ontario No. 2" is a steel built, twin screw vessel of 3,376 tons net, 5,563 tons gross, registered at Montreal, official number 137,978, owned by the Ontario Car Ferry Company, Montreal, speed about 13 miles per hour, drawing 16 ft. 9 in. forward and 16 ft. aft at the time of casualty.

Summarizing the evidence of the master, it is found that he had allowed the second officer to absent himself from the ship owing to illness in the latter's family, and, having no other certificated officer on hand besides the first officer, he placed, and left the watchman—a young fellow who did not impress the court favorably as a dependable individual for any position of trust—in charge of the bridge, without specific instructions, at about 1.10 a.m. January 23rd, while en

route from Charlotte, N.Y., to Cobourg, Ontario, and thereupon went to his office and slept, though it is evident by the testimony given, that there was mist, fog, that, in fact, it was not clear weather.

It is true that at this season of the year there was no traffic excepting the daily meeting of the sister ship "Ontario No. 1." Therefore the absolute compliance with the rules of the road as to diminishing speed and having a man on the lookout was disregarded.

The mate relieved the watchman at two o'clock, instead of taking his watch at 12.30 a.m., this surcease from duty at the regular time having been granted by the master.

The leaving of the bridge duty to an irresponsible individual such as the watchman would have been termed absolute carelessness and wilful avoidance of responsibilities; but under the circumstances, there being no expectation of encountering other ships, and with the system existing by which the wheelsman practically appears to be the dependable man, upon whom the responsibility of steering the right course rests, the master confidently went to his room.

Having performed the service regularly for five years, twice daily, steering practically the same course and occupying the same space of time in transit from Charlotte to Cobourg and vice versa, caused the master to be overconfident, which the court deprecates.

With regard to the first officer, Walter Kirk, the court is partially nonplused at his evidence with regard to the foggy conditions—that he came to and entered a fog bank, emerging from it immediately, then land lights were seen; but too late. It is said, and it is also to the knowledge of the court, that the light at Cobourg can be seen at least seven miles out.

If he suddenly entered the fog bank when so close to land, how did it happen that he did not, prior to that, see the glare of those lights? If he had been perfectly awake to his responsibilities, it was his duty to call the master; instead, he continued on the course and speed, with only one idea in mind, that is, to call the master when the four hours and ten minutes were up. He had no report from the engine room that the number of revolutions were as usual, but trusted entirely to time and the clock, and did not attempt to reduce speed, nor heave the lead; in fact, elementary carefulness was forgotten or omitted.

When lights were seen so close that it necessitated a sudden and immediate alteration of the helm, he omitted, or showed lack of that presence of mind and judgment to operate his engines simultaneously with the helm. The court does not mean that at that juncture it would have prevented the ship from grounding; but it was a necessary, important action and one of elementary seamanship.

It has been noted that the movements of the engines are not entered in the engine room log book, as when the ship was ordered slow and full speed.

It is noted that both the bridge and engine room logs fail to show mention of events or operations which are considered important to all concerned.

It is suggested that the office should issue instructions which would remedy that lack of recording of such as courses, winds and the working of engines.

Other witnesses did not throw any further light on this casualty; but it is apparent that material contradictory statements with respect to the state of the weather were made; but coming from inexperienced members of the crew, the court did not attach importance to such contradictions. Hence the following finding:

Finding

The court, having carefully reviewed and weighed the evidence adduced, which was somewhat contradictory with respect to the density of haze or fog existing during the passage of the vessel from Charlotte to Cobourg, finds that when the master, Captain F. D. Forrest, left the bridge in charge of an irresponsible man, an employee who could not be trusted owing to his total and absolute ignorance of navigation and seamanship, he committed a breach of the faith and trust which his owners had placed in him.

In view of his long service, the record of which is without a blemish, the court will be lenient and will not deal with his certificate; but reprimands him severely and cautions him that whenever he dispenses, even momentarily, with the services of a certificated officer, and having no other to replace him, he assumes the duties of the absentee, that of keeping watch.

As for the first officer, Walter Kirk, the court finds that he failed to keep a proper lookout himself, as well as having a lookout man at a place of vantage. He was neglectful in not reducing speed and in not calling the captain at once before entering the bank of fog, and when the time allotted usually to make the trip had about ended.

Moreover, he showed poor seamanship in not ringing full speed astern on the port engine, jointly with his order of hard to starboard. His carelessness in keeping his log is also taken into account.

For these reasons the court suspends the certificate of Walter Kirk, as master, No. 7635, for the period of three months to date from the 18th of March to the 17th of June, 1921, inclusively.

The court looks askance at the apparent slipshod method in which the deck and engine room logs are kept. In the chief engineer's log the time is not shown when the engines were put full speed upon leaving Charlotte.

The court therefore recommends that accurate entries be made of essential events.

Other members of the crew are exonerated.

Read in open court at Cobourg, Ontario, this 18th day of March, 1921.

(Sgd.) L. A. DEMERS,
Dominion Wreck Commissioner.

Concurred in by

(Sgd.) J. B. FOOTE,
(Sgd.) GEO. D. FREWER,
Nautical Assessors.

RE S.S. "CITY OF COLOMBO"

In the matter of a formal investigation held in the Board of Trade Rooms, St. John, N.B., on 28th and 29th March, 1921, which was presided over by Capt. L. A. Demers, F.R.S.A., Dominion Wreck Commissioner, assisted by Captain A. J. Mulcahy and Captain John Hall, S.S. "Pretorian," to enquire into the causes which led to the stranding and total loss of the S.S. "City of Colombo" on the 20th March, 1921, at a place about sixteen miles west of Digby, Nova Scotia, in the Bay of Fundy, after leaving the port of St. John, N.B.

Mr. F. R. Taylor, K.C., represented the interests of the owners and master.

On the 26th March the witnesses examined were Captain J. J. Robertson, certificate No. 006,255, Third Officer C. E. Bramhall, second mate's certificate No. 009,895, wheelsman and lookout man, and D. P. White, Marconi operator; while on the 29th March Pilot Fenwick McKelvie, Second Officer W. H. Short, master certificate No. 003,690, and Third Engineer John Brisbane were examined.

The S.S. "City of Colombo" is a steel built, single screw vessel of 3,909 tons net, 6,000 tons gross, with triple expansion engines, carrying a crew of 75, including master, three certificated deck officers and five engineers; her speed being nine knots, length 425 feet, beam 54.1 feet, draft at time of stranding being 13 feet 5 inches forward and 21 feet 8 inches aft, official No. 128,009, of Liverpool. She was bound from St. John, N.B., to Philadelphia, thence to ports not yet determined.

The master said it was his first command, and that he had been in St. John once before whilst first officer. Otherwise he was a stranger to the waters.

Summary

The evidence submitted by the master and corroborated by other witnesses, as to courses and condition of weather, shows that, after the pilot left the ship off Partridge Island, he steered a course to make the buoy,—outer St. John Harbor buoy,—passing close to it.

After passing the buoy, a course was set to pass within a safe distance of Point Lepreau, when he again shaped a course,—after the sound of the fog signal at that point was found abeam, and determining that he was about 2½ to 3 miles from it. He did not cast the lead, nor obtain a cross bearing; but approxi-

mately fixed a position for departure. His intention was to pass west of Grand Manan; but the weather becoming thicker he altered his mind. He had been steering S 85 W up to the time Point Lepreau fog signal was heard abeam, then altered to S 1 W true.

His first error, especially for one who was a stranger, and not having noticed whether the cargo of iron taken in the 'tween decks had affected his compass, was his failure to either take cross bearings of the fog horn or cast the lead to assure himself that his vessel had made good the course and distance.

This was necessary in view of the fact that nothing could be seen owing to the fog which had then increased, and more especially as he admitted lack of knowledge of the error of his log, which he thought was fast,—even erratic,—and the possible drift of his ship,—it then being ebb tide, the strength of which he evidently could not then estimate, and again because of his forgetfulness to see for himself or give instructions to his officers to note if the compass had been affected by the iron placed on his ship as cargo.

The Court will not say that at the distance the iron was from the standard compass that the magnetic influence of the iron in the cargo would have appreciably caused a greater deviation than that observed previously on the passage out; but a disturbance was possible under the circumstances.

It does appear to the Court that the master's duty was to either watch the standard compass, or send one of his officers to note if there were any changes in the deviation. However, this was not done,

The lead was cast frequently. Had not the master been imbued with a fixed idea that he was near Grand Manan, it is possible that soundings would have been taken oftener still, especially as he felt that he was lost in his calculations.

An experienced sailor would, in such circumstances, failing to find deep water on a course which presumably was leading towards it, have stopped or retraced his steps.

Why did he not avail himself of the Direction Finding Station at Red Head? He had a wireless on board, and in such an impasse, being absolutely nonplused as to his position, and the results of his soundings, a fairly accurate fix could have been obtained by availing himself of those very useful aids to navigation. There was nothing to prevent him from asking for several bearings, more especially as no charge is made for same.

Though at times the speed was slow, at the time of grounding the vessel was going half speed. It was then still water, or beginning of the flood tide. Had he remained stationary, with the SW wind, it would have gradually brought him toward deeper water, or in such an impasse he could have let his anchor run down slowly and await events.

However, while the Court feels that the master, who remained constantly at his post, did use the lead with some frequency, which is appreciated, and therefore precludes any carelessness in that respect, yet is of opinion that he erred gravely in not availing himself of the means which were easily obtainable to determine his position, and for the following reasons:

Firstly—Failure to watch himself, or cause his officers to observe the behavior of the compass whilst the ship was heading for Partridge Island.

Secondly—Shaping a definite course when he had but one bearing of a sound.

Thirdly—For not taking into serious consideration the unknown error of the log, which he termed erratic.

Fourthly—For not availing himself of the invaluable use and service of the Direction Finding Station at Red Head, for which no fee is charged.

Finding himself totally at a loss as to his whereabouts, the Court cannot understand why he proceeded at half speed in such a fog.

If his statement is to be seriously considered that he thought himself on Grand Manan side, though a stranger in these waters, ordinary reasoning of the situation, that the flood tide was about to make, would have shown him that the tide would have taken him into deep water, and away to the east and north of the Bay and to safety.

He evidently showed lack of confidence in his compass, as he did with the log. Had he observed his compass when leaving St. John it would have served to inspire him with greater confidence.

Whilst the soundings were taken as he states, frequently, yet in such a position they were not frequent enough, since he traversed the deeper part of the Bay unknowingly. Had he kept on the course S 4 W it would have led him clear of all dangers.

He knew of the Direction Finding Station at Red Head, and had he been on the alert he would have received the message which was transmitted to the Canadian Pioneer. Instead he was satisfied that the Canadian Pioneer was close to him, without ascertaining the exact position, either from that vessel or the station.

That part of the evidence relating to shoals where fishermen have been seen is not seriously considered by the Court. Fishermen have been seen everywhere about the Bay, in deep as well as in shoal waters.

There had been no special condition of the weather which would have caused the ebb tide to flow differently than usual. The wind was light, with no sea.

Therefore the Court cannot find any justification in the evidence for the loss of the "City of Colombo."

Hence, upon those points, the Court renders the following finding:

Finding

The Court, having carefully weighed the evidence adduced, finds that Captain J. J. Robertson, certificate No. 006,255, failed:

First—To watch himself, or cause his officers to observe his compass when leaving the wharf at St. John, and whilst proceeding towards Partridge Island.

Second—In shaping a definite course, S 4 deg.W on a position or departure obtained by a single sound of the Point Lepreau fog horn, and establishing a very approximate distance from the fog station.

Third—To take into serious consideration the unknown and unchecked error of the log, which instrument he termed erratic.

Fourth—In ignoring the existence of the Direction Finding Station at Red Head.

For those reasons the Court is unanimously of the opinion that Captain Robertson is solely in default, and therefore suspends his certificate for a period of three months from the 29th March, 1921, to 28th June, 1921, inclusively.

The officers and engineers are exonerated from all blame.

Rider

Pilot Fenwick McKelvie pointed out to the Court that he has often seen fishing vessels at a point which he has marked on the chart,—45.35 N., 66.20 W.,—which is only an approximate bearing, which is supposed to be shoaler than other places, and which is not shown on the chart amongst the soundings.

The Court would suggest that in view of this that further inquiries as to the existence of such a bank should be made.

The Court's personal knowledge of the Bay of Fundy is that fishermen have frequently been seen in any part of the Bay of Fundy fishing, but this does not indicate that those places are shoaler than shown on the chart.

Read in open court at St. John, N.B., this 29th day of March, 1921.

(Signed) L. A. DEMERS,
Dominion Wreck Commissioner.

Concurred in by
(Signed) ANDREW J. MULCAHY,
(Signed) JOHN BALL,
Nautical Assessors.

RE SS. "KADUNA."

In the case of a formal enquiry into the stranding of the SS. "Kaduna" on Pot Rock, off Forchu Head, C. B., on 23rd February, 1921.

Enquiry held in the Court House, Halifax, on Tuesday, 15th March, 1921, before Capt. Henry St. George Lindsay, Commissioner, assisted by Capt. C. L. Willate and Neil Hall as assessors.

Summary

The SS. "Kaduna" of Liverpool, registered tonnage 2,308, owned by Elder Dempster & Co., sailed from Barry Roads, in ballast, drawing 18 ft. 3 in. fore and 18 ft. aft, on 9th February, 1921, bound for Louisburg, C. B., to load part cargo, carrying a crew of 48, including the master, three officers and four engineers, and one wireless operator.

On 22nd February the noon observation placed the vessel in Lat. 44.38 N.

and Long. 58.59 W., and on the receipt of various wireless messages and reports as to the ice conditions off the coast, both from vessels and the shore stations, the master decided to approach the land well to the westward of his port of destination, and at 3.30 a.m. on 23rd February, after steaming through ice from 10 a.m. on 22nd February and steering various courses, the vessel's position was found by cross bearings of Green Island and St. Esprit Island lights, to be in Lat. 45.32 N. and Long. 60.33 W., and a compass course (N. 84 E. 26, westerly error) was set to pass well clear of all outlying dangers, but with the intention of keeping as close to the land as practicable, where the ice was supposed to be lighter than that off shore.

Finding of the Court

The evidence adduced before the court, which was of a most satisfactory character, and given in a perfectly straightforward manner, shows that the vessel was supplied with a proper number of compasses, which were all in good order and condition, and sufficient for safe navigation, and were properly adjusted by Messrs. Bruce & Sons in Barry Roads on February 9th, 1921, just prior to the vessel's leaving, and a proper set of deviation cards were supplied to the master.

Observations for compass errors were taken on all possible occasions, and apparently all corrections properly applied to the courses, etc.

The vessel was fully supplied with all necessary charts, sailing directions, etc.

The position of the vessel at 3 a.m. on February 23rd was ascertained by good cross bearings and was verified later by her 3.57 a.m. position, when three miles off St. Esprit Island light, and the compass course set at 3.30 a.m. (N. 84 E.) was, in the opinion of the court, a safe and proper one under the existing conditions.

The lead was not used, as there was apparently no necessity for so doing, and a good and proper lookout was kept.

The vessel struck on Pot Rock, one and one-half miles off Fourchu Head, having in the opinion of the court been gradually carried inshore by the ice pressure to starboard, which, on account of the weather conditions existing at the time, and the darkness, was not perceivable to those in charge. The court was unanimous in the opinion that the ice drift was to the north and westward, or towards the land.

The vessel was found to be considerably damaged, under the port bilge, principally of B plate.

The navigation of the vessel was carried out in a careful and seamanlike manner.

The court exonerates the master and officers from blame for the casualty, but is of opinion that the risk undertaken in navigating the vessel during darkness in such close proximity to the land and under the existing circumstances was not justifiable, and therefore cautions Robert Owens, master, in future not to allow his better judgment to be influenced, which apparently was the case, by information and reports (somewhat belated when received) on ice conditions, which are liable to continuous and rapid changes, more especially in light winds and fine weather.

The court is also of opinion that had the master been aware of the non-existence of the light on Fourchu Head, the casualty would not have occurred, and therefore would strongly recommend that all shore lights and lighted buoys listed in the light lists, which are either extinguished or removed during the winter season, should have a note to that effect in the remark column of that publication, for the benefit of all concerned.

(Sgd.) H. ST. G. LINDSAY,
Commissioner.
(Sgd.) C. L. WILLATE,
(Sgd.) NEIL HALL,
Assessors.

Halifax, 18th March, 1921.

BRITISH BUILDING NEWS

(Continued from page 33)

aft with entrance house and sanitary arrangements on top. Steam heating will be provided in all midship accommodation with heaters to the baths and freshwater condenser will be fitted on casing top amidships.

The steamer has 4 large holds with a reserve bunker and 5 large hatches, and has 2 winches to each main cargo hatch, those at No. 2 being coupled together for heavy lifts. Winch with extended ends is fitted at the reserve bunker. The vessel has 2 telescopic masts and 2 derrick posts at the reserve bunker hatch, each hatch being served by 2 derricks and in addition a 15-ton derrick at No. 2 hatch. Six cargo port doors are fitted for access to the 'tween decks.

Wireless apparatus will be installed and the vessel will have 2 lifeboats and 2 dinghies, electric light throughout, Morse lamp and semaphore, steam windlass forward and warping winch aft, and in addition to the usual fairlead, special Panama fairleads will be fitted at the bow and stern.

Water-ballast will be carried in cellular double bottom and in fore and aft peaks.

Nos. 2, 5 and 6 tanks are arranged for the carriage of oil fuel as well as two small oil fuel bunkers in the engine room. Heating pipes and coils will be provided for these bunkers and for the oil fuel tanks, steam being direct from the boiler tops through reducing valves and distribution chests. Each tank is controlled separately and the exhaust coupled together and lead to observation tank in engine room supplied with the usual fittings.

Triple expansion engines, placed amidships, having cylinders 25 inches, 41 inches and 68 inches by 45 inches stroke, supplied with steam by three large single ended boilers working at 180 pounds pressure, will be installed by Messrs. Richardsons, Westgarth & Co., Ltd., Middlesbrough. The boilers are arranged to burn either coal or oil on the Wallsend-Howden patent system of oil fuel burning, consisting of two sets of pumping and heating plants and two transfer pumps of Weir's make for transferring the oil from the bunkers to two large settling tanks which will be provided with the necessary gauges, drain cocks, filling and discharge valves, thermometer pockets, overflow pipes, air pipes, etc., all to Lloyd's latest requirements.

On leaving the ways the vessel was gracefully named "Monte Viso" by Mrs. Smith, wife of Mr. C. F. Smith, of West Hartlepool.

The hull and machinery are being constructed under the superintendence of Commandant A. Robillot, with Messrs. C. E. Smith & Son, West Hartlepool, as local superintendents.

It is nearly ten years since Swan, Hunter & Wigham Richardson, Ltd., launched a "Laconia," sister ship to the "Franconia," for the Cunard Steamship Co., Ltd. Unfortunately, both these fine ships were lost during the Great War. The new "Laconia," now being built, is of much the same length as her predecessor, but has a greater breadth and is to be driven by steam turbines in the place of reciprocating engines.

The leading dimensions of the "Laconia" are: 623 feet 9 inches extreme length, 73½ feet moulded breadth and 45 feet in depth to the shelter deck. The gross tonnage will be about 21,000 and her sea speed 16 knots. The ship is being built to Lloyd's highest class. She has a straight stem and elliptical stern and will be provided with two pole masts and one funnel. Very comfortable accommodation will be provided for about 340 first-class and 340 second-class passengers. The public rooms for the first-class passengers will consist of a spacious lounge, smoke room and drawing room, a dining room, garden lounges and a gymnasium. In the second-class accommodation there will be a dining room, smoke room, verandah café and a drawing room. Accommodation will also be provided for 1,500 third-class passengers and they, too, will have a dining room, a general social room and smoke room. The captain will be provided with a most comfortable suite of apartments communicating with the navigating bridge. There will be separate smoke rooms for the officers and engineers. For all the passengers there will be ample provision of baths, lavatories, etc., as well as hospitals, a dispensary and an operating room. The galleys, pantries, baker's shop and refrigerated store rooms for perishable provisions will all be most complete. The outfit of boats and life-saving apparatus will all be in accordance with the British and American authorities and to the requirements of the international convention for a passenger steamship.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

AN INTERESTING PIPE-BENDING MACHINE.

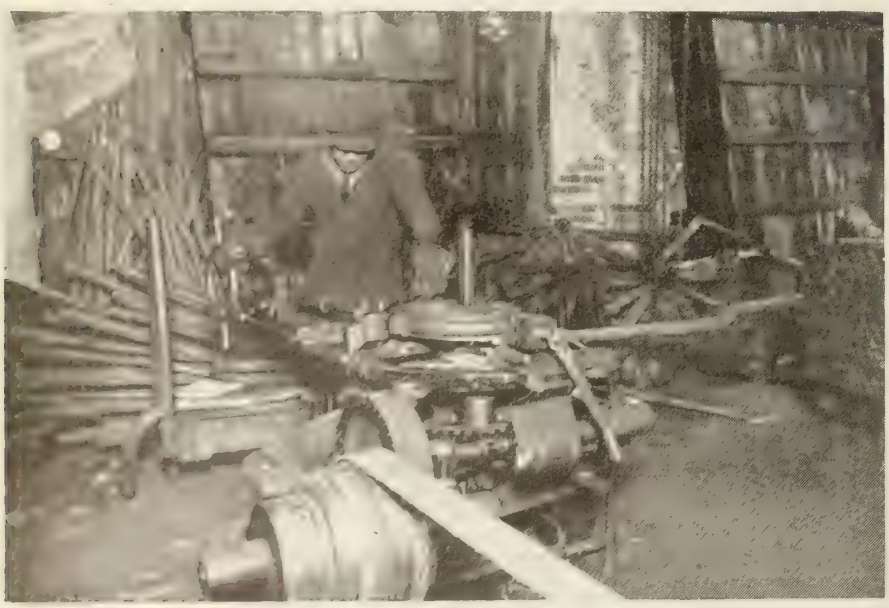
The problem of bending wrought iron pipes to various degrees and getting the bend without distortion of the pipe has always been an interesting one. Many devices have been introduced to achieve the desired result, and we recently had the opportunity to see one of these at work. The machine in question is owned and operated by the Tube and Pipe Bending Co. of Ontario, St. Nicholas St., Toronto.

The device is made in two sizes, the smaller size being used for pipe up to 2-inch diameter, while the large machine can handle up to 6-inch extra heavy. The bending is, of course, carried out without any heating of the pipe.

The accompanying photograph will give a good idea of the machine and the principle on which it works. The drive from the belt pulley is transmitted by a worm to a worm wheel revolving in a horizontal plane underneath the table. On the table is mounted the form for bending, and these forms are, of course, made to accommodate the various sizes to be bent. The pipe to be bent is placed in the jaws of the vise and is run through between the form and vise the necessary distance to form the bend. The mandrel carried on the table is then run into the pipe just as far as is necessary. A series of stops on a quadrant under the table can be set to any number of degrees that may be required. When the pipe is set, the operator presses a pedal, which throws the head carrying the mandril into gear with the revolving worm, thus turning the head and mandril, and, of course, the pipe, through the arc previously settled. When the stop is reached, the machine disengages automatically. The mandril, owing to the path described by the table, automatically draws out of the pipe as the bend is formed.

The machine can be used to put several bends in a pipe, and we saw a number of exhaust pipes for automobiles which contained no less than five bends. One great feature with a machine of this kind is that, once it is set, it can produce any number of absolutely identical bends. This makes it especially useful where large numbers of pipes must be bent to a uniform standard. We had an opportunity to examine some four-inch pipe which had been bent to about 60 degrees, and there was no sign of any wrinkles or distortion on the inner side of the bend. A large number of bends on extra heavy pipe for marine work were performed on the large machine during the shipbuilding activities recently, and were all passed by Lloyd's surveyors.

We understand this machine is fully protected by patents in Canada and the U. S.



BENDING AUTOMOBILE EXHAUST PIPES.

ROTARY PISTON PUMPS

The St. Louis Pump & Equipment Co., St. Louis, Mo., have placed on the market four different styles of their duplex rotary piston pumps.

Briefly, the pump consists of twelve principal parts, these being the pump case with dividing partition, two end plates, a steel shaft with two eccentrics mounted thereon, two pistons, two rocker arms and two checks.

Two chambers or cylinders with shaft passing through centre of each—two eccentrics, directly opposite in throw or 180 degrees apart, mounted on the shaft. Surrounding these eccentrics are the two pump pistons. These pistons are pivoted to the rocker arm, which serves to produce the reciprocating movement of the piston through the action of the eccentrics.

In this way a composite reciprocating and rotary motion of the pump piston, without actual contact of piston and cylinder walls, is obtained. The clearance, however, is so small that a liquid seal results, and so positive is its action that after long service it is said to pull better than 29 inches of vacuum.

The piston check is the only moving part touching the cylinder wall, and this functions only at the point of transition at the end of the pumping suction movement or stroke to the beginning of a new stroke. The wear on this check is taken up automatically. While the piston is discharging, it is acquiring fresh liquid on the opposite or suction side, and the piston in the opposite chamber is functioning conversely, thus giving balanced action and continuous flow.

The head at one end of pump case is blind—that is, the shaft does not extend through. This eliminates packing. At the other end, a gland which holds the packing material is bolted to the head. This gland is separate from the bearing bushing. The gland is designed to act simply as a gland, and the bearing bushing to serve solely as a bearing.

The pump is very compact, light in weight and is said to be practically free from vibration. It is also self-lubricating.

Various accessories and variations from standard equipment can be attached, these including pressure gauge, air chamber, by-pass and relief valve, foot valve, strainer, flanged pipe connections, electric remote control, etc. One style will pump lubricating oils from the lightest to the heaviest, in fact the pump is said to be able to pump any liquid of a non-volatile nature that can be handled in metal. The other types are, of course, for varied purposes, but as stated before we have not the space to enter into detail.

The Oliver Engineering Co. are removing their Montreal offices and show rooms from 296 St. James Street to 307 St. James Street. This firm has recently installed some large hand operated cranes in the new power plant of the Montreal Harbor Commissioners and also in the plant of the Anglo-Canadian Wire Rope Co.

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MARINE NEWS FROM EVERY SOURCE

Sault Ste. Marie.—The steamer "Sir Thomas Shaughnessy" was first through the locks at the Soo this year, and she went through twelve days earlier than any vessel did in 1920. The same boat was also one of the last down at the close of navigation last year.

Fort William.—Navigation was opened at Fort William this year by the steamer "Shaughnessy," Captain William Atkinson, which arrived in the port on April 9. The "Shaughnessy" came to load grain for the lower ports, and her captain was presented with the usual silk hat as a mark of distinction for being the first boat in.

Collingwood.—The Collingwood Shipbuilding Co. at its recent annual meeting elected the following officers, who were all in office during 1920. They were: President, H. B. Smith; vice-presidents, J. W. Norcross and R. M. Wolvin. Directors, H. W. Cowan, F. S. Izzard, S. Dyment, J. S. Leitch; secretary-treasurer, S. H. Lindsay.

Halifax.—At the recent inquiry into the loss of the Imperial Oil Co. steamer "Impoco," which occurred on Blond Rock early in April, the captain was exonerated from all blame. The chief officer, Charles Edward Pope, of Newfoundland, had his certificate suspended for twelve months. The severity of the sentence was due to the carelessness of the chief officer in carrying out his duties.

Toronto.—Judgment was given here recently in the case of the tug "Whelan," which last fall cut adrift from a scow that she was towing. There was a heavy gale blowing at the time, but in the opinion of the court the captain could have run before the gale instead of trying to make Port Hope as he did. Judgment was given for damages for the loss of a cargo of stone and repairs to the scow.

Sydney, N.S.—The Sydney Board of Trade recently sent a memorial to their local member of parliament suggesting that the steamers of the Canadian Govrnent Merchant Marine that are now lying idle at Halifax should be used to carry Nova Scotia coal from Sydney to South America. The Dominion Coal Co. had worked up an extensive export trade before the war, which they had lost through lack of shipping, and it is suggested that the Government ships be chartered to them.

London.—The coal strike in England has resulted in a change of schedule of the trans-Atlantic liners. The companies affected are the White Star, the P. & O., the Orient and one of the Japanese lines. The River Tyne is full of steamers unable to get coal, and there are said to be 216 of them, including 65 Government steamers.

Sault Ste. Marie.—The first accident of the navigation season occurred on April 14 when the steamer "Martin Mullen," bound from Fort William to a Georgian Bay port, went aground off Whitefish Point light at daybreak. Tugs were despatched to her assistance immediately.

Montreal.—The Canadian Government Merchant Marine are starting a new service on the Pacific coast between Vancouver and Vancouver Island points, and Seattle, San Francisco and Wilmington on the United States coast. The ships that will be utilized on this service will be the "Canadian Rover," "Canadian Farmer" and "Canadian Beaver," each of 3,940 deadweight tons. There will be sailings every ten days.

Montreal. — The Canadian Vickers, Ltd., launched the steel cargo steamer "Idefjord" from their Maissoneuve yards early this month. This is the earliest launching to take place in Montreal. The vessel was constructed for the shipping firm of of Den Norske Amerikalinje, of Christiania, Norway. Another vessel for Norwegian register will be launched from this yard in the course of the next few weeks. Two Canadian Merchant Marine freighters, launched last fall, will shortly be turned over to the owners. The outlook for future building at this yard has been clouded by the prevailing high costs of construction work and the keen competition from yards in other countries.

St. John, N.B.—The Canadian Pacific liner "Empress of France" made a new record for the Liverpool and St. John run on her last west bound trip. She made 2,903 miles in 6 days 8 hours 42 minutes and averaged 19.01 knots. She took the southerly course to avoid ice fields. She carried 1,471 passengers.

Montreal.—In contradiction of the reports that freight rates on the Lakes had been raised this season, Mr. W. E. Burke, superintendent of transportation for the C.S.L. lines, said that their company had reduced its rates on coal, grain, ore and merchandise.

Three Rivers.—It is quite probable that a steamship service will be instituted in the near future between Three Rivers and the United States. J. E. Aldred, president of the Shawinigan Water & Power Co., says that the project has been in mind for some time past, and is due to the growth of the paper pulp and chemical industries on the St. Maurice River. The various industries will therefore be connected with their United States markets direct by water.

Montreal.—The service carried on during the war between Montreal and continental ports by the steamers of the Canada Line will be shortly renewed. The services in question are those between Antwerp and Rotterdam to Quebec and Montreal westbound, and from Montreal to Cherbourg, Antwerp and Rotterdam eastbound. There will be alternating services to Hamburg, Danzig and Libau. The vessels used will be the "Samland" and "Maasdam" of about 9,000 tons gross, and they will carry third-class passengers.

St. John.—The last Atlantic passenger liner to come into the port of St. John for the winter season of 1920 and 1921 was the "Melita," which arrived on April 20th. She had a full passenger list, in addition to a large general cargo. Among the passengers were a relief crew for the British cruiser, "Cambrian," on the West Indies service, which is in Halifax awaiting them. There were also a number of members of a British party brought out under the auspices of the C.P.R. colonization department. This party had between them about $250,000.

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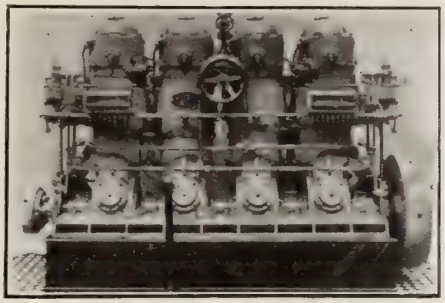

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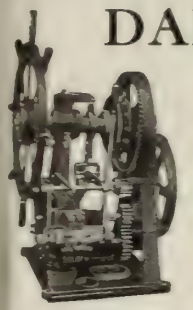

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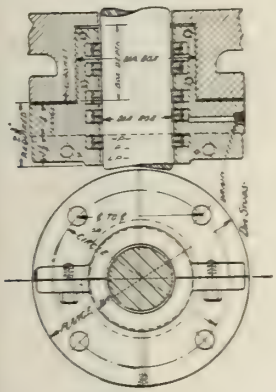

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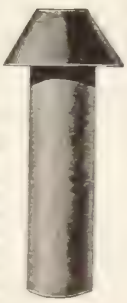

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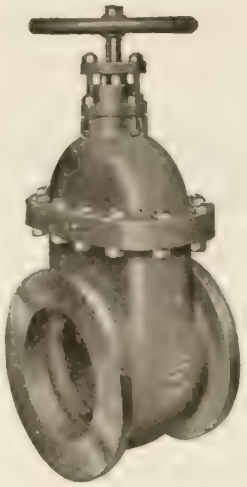

Fig. 402.

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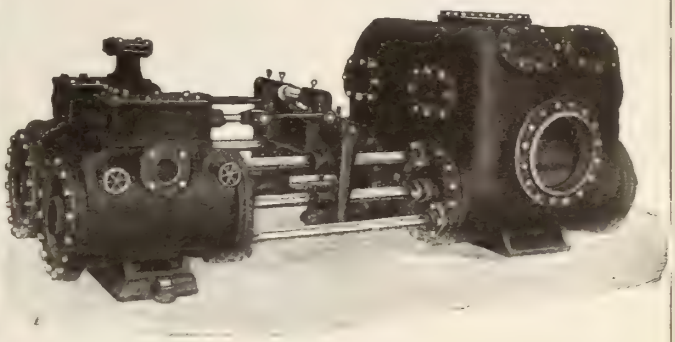

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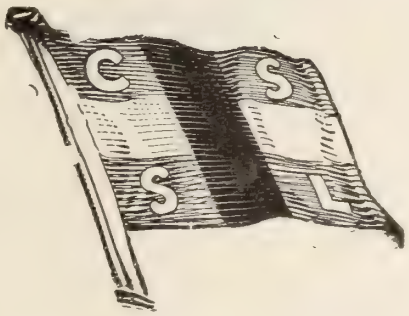

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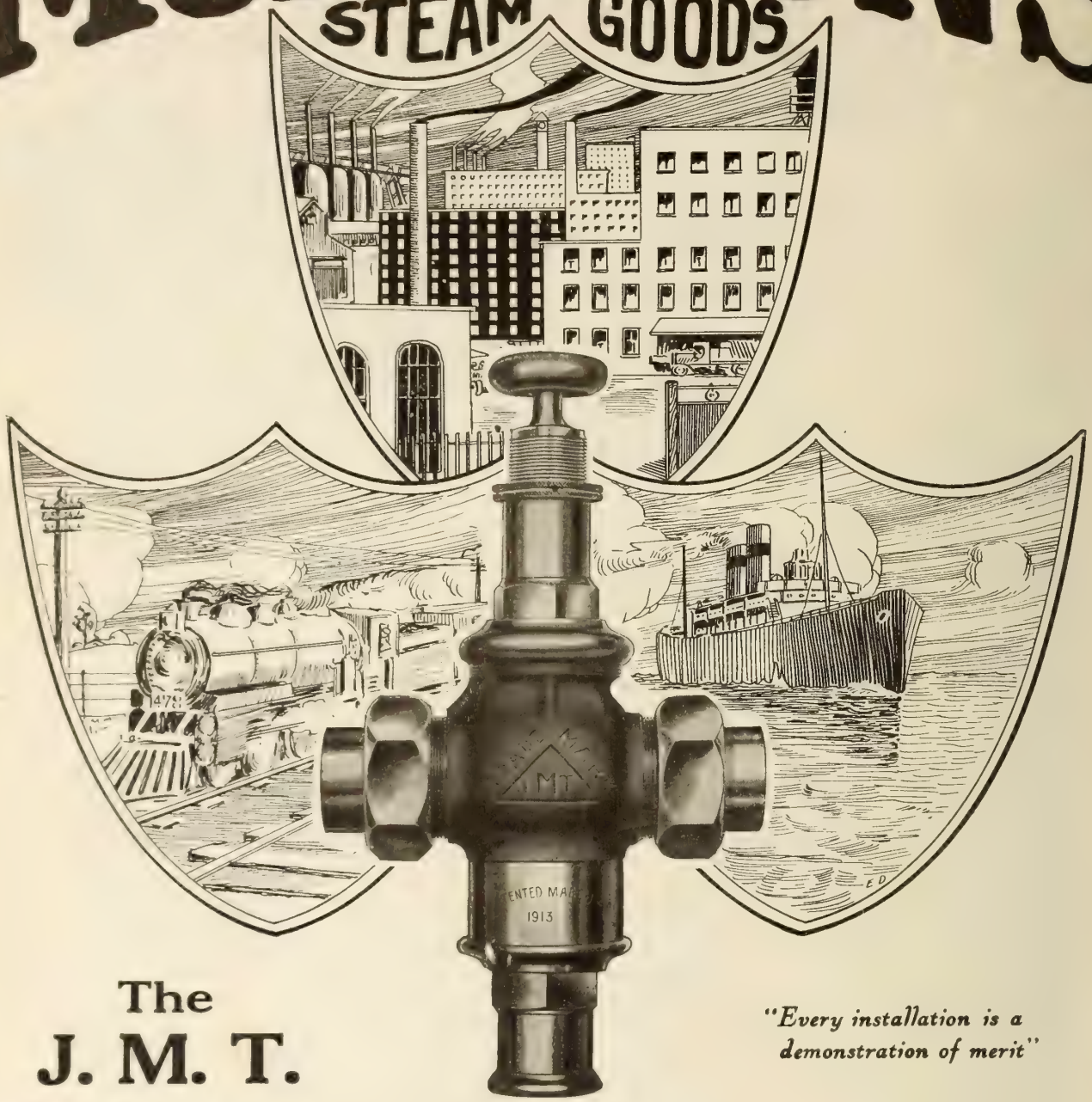

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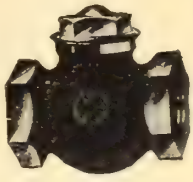

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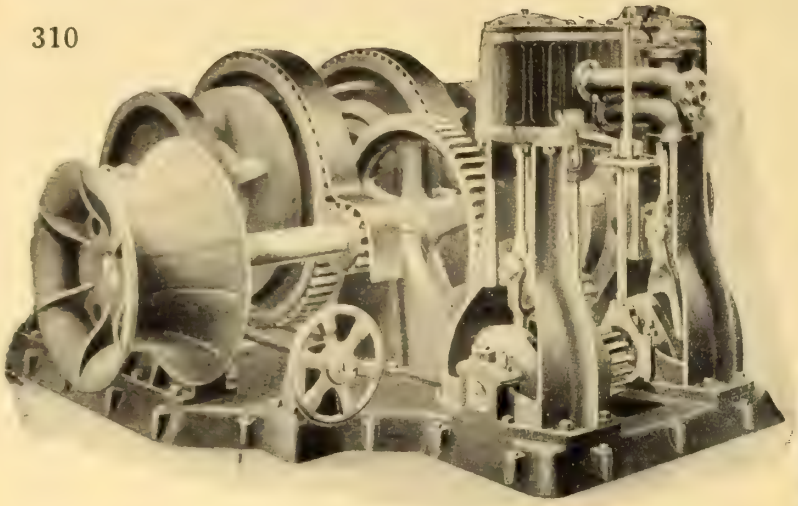

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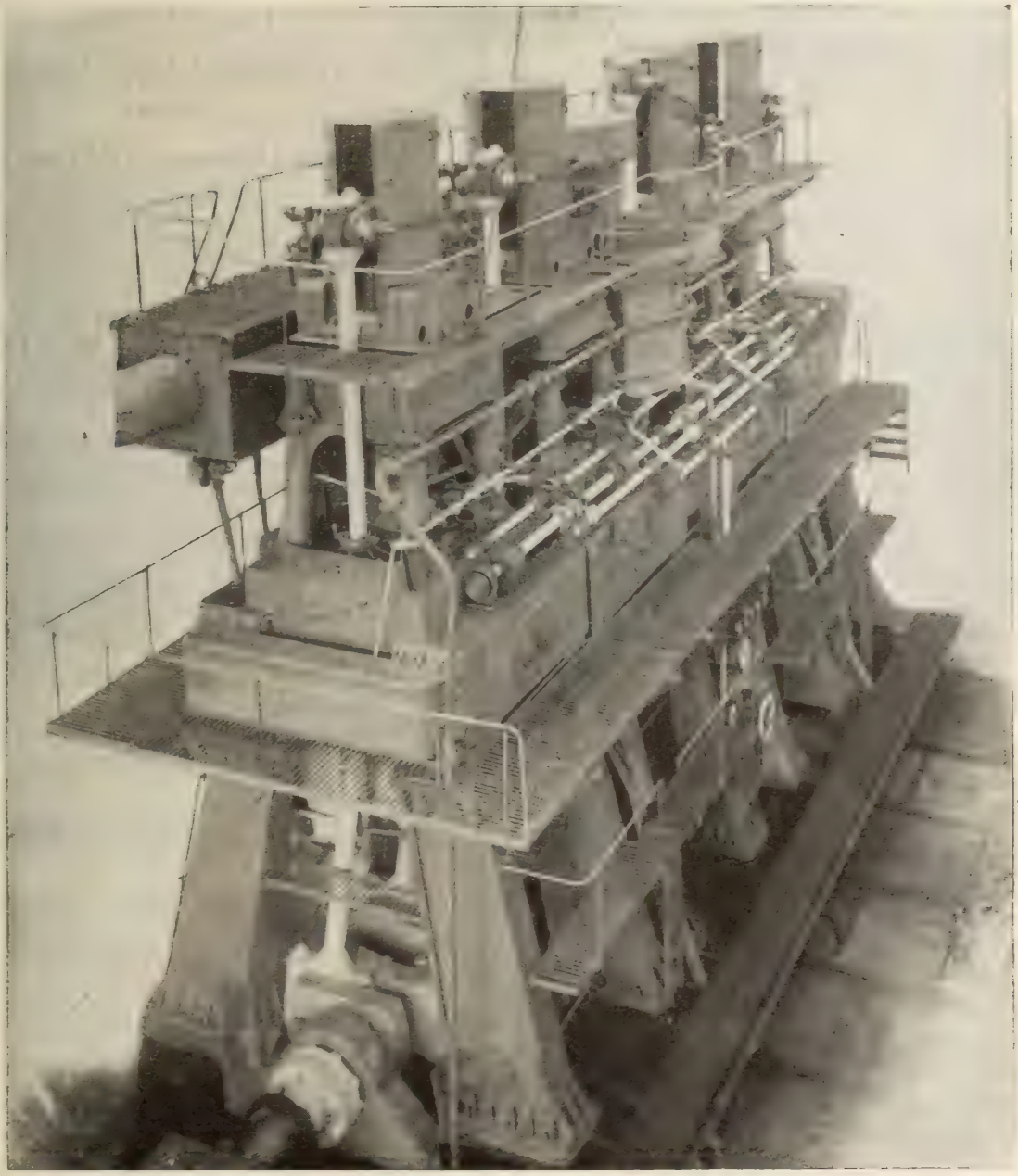

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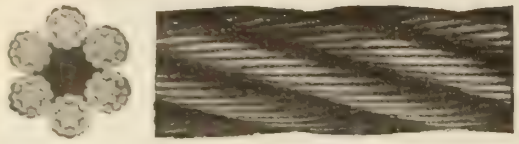

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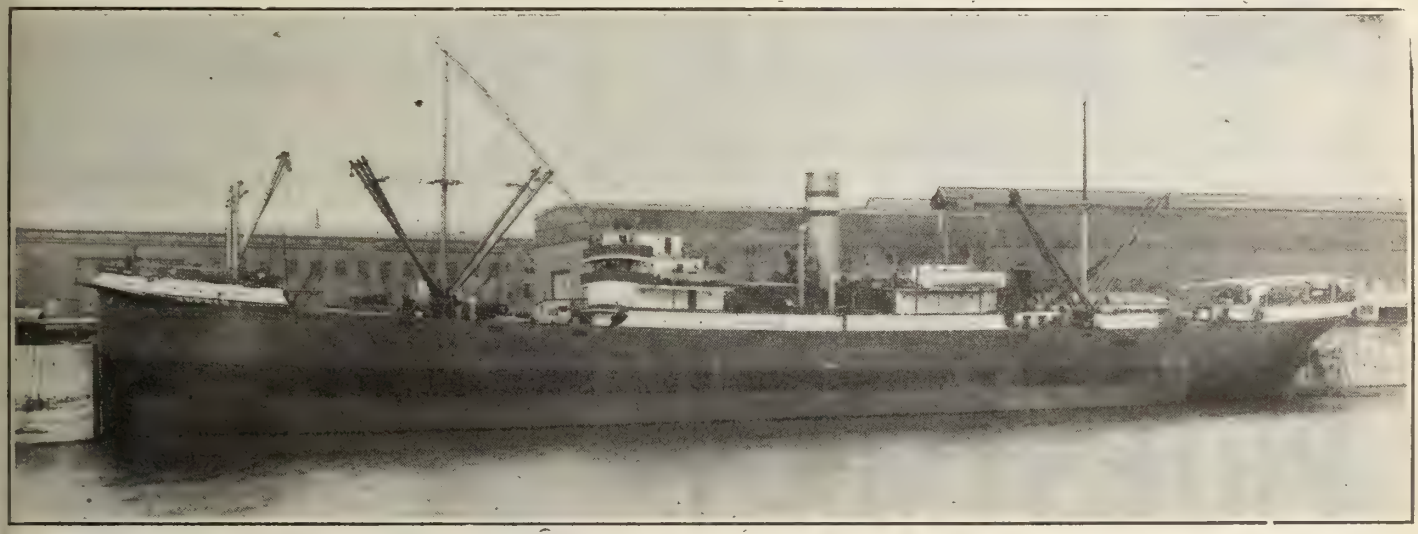

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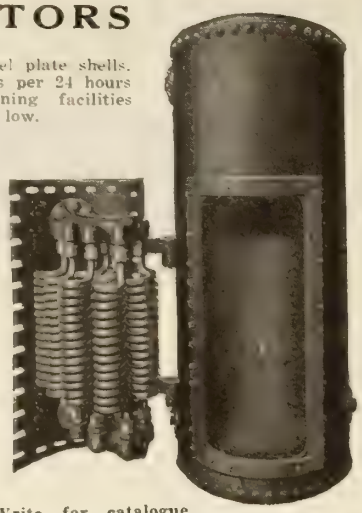

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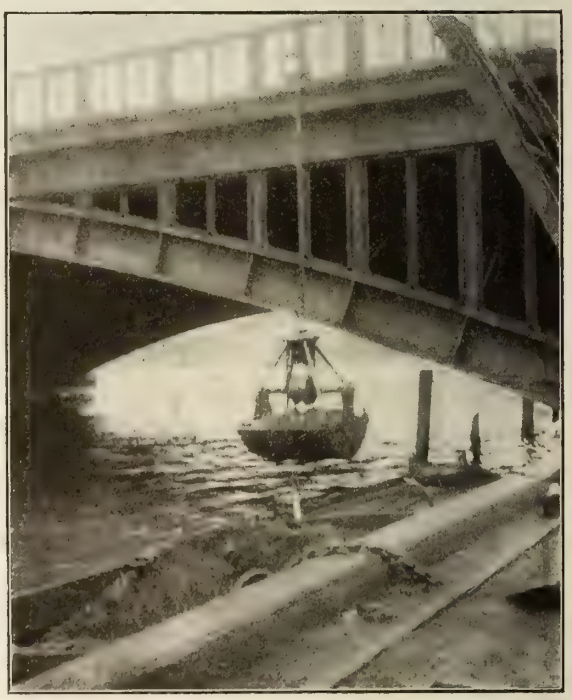

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"Canada Holds the Key"

Agnes C. Laut, in the May 15th issue of MACLEAN'S MAGAZINE, uses figures and facts that prove the future heart-beats of the great oil-burning leviathans of the ocean lanes will depend on the lakes of fuel that will be sucked up from the "basement" of Northwestern Canada. In an article, "Strangling Our Oil Goose," Miss Laut emphasizes:

"Canada has the oil. Canada holds the naval and merchant marine key of America. Edmonton in your generation and in mine will be a second Pittsburg. Great tankers will float out from Prince Rupert to supply the Orient. Tank cars will become as common across our prairies as grain cars. Our National Railways will—"

But you will have to read this talented author's article to get the picture she visualizes of the future of Western Canada when the development of oil resources of the North is at its zenith.

There is a strong hint in this article of Miss Laut's that Canada may "strangle her oil goose" by too much so-called caution. Read MACLEAN'S MAGAZINE, May 15th, and discover how Miss Laut argues that Canada will spoil her chances for control of the oil situation in North America and great wealth—if she *is not careful.*

A Tempting Array of Fact and Fiction

Take a peep into the May 15th issue of MACLEAN'S! Besides Miss Laut's article:—

"He Who Laughs Last-----!"
By Frederick William Wallace

A thrilling short story of action. Setting, the Atlantic coast: characters, deep-sea fishermen. Written by the dean of deep-sea short fiction writers.

"Canada Counts Noses"
By Nicholas North

Did you know that the first systematic census of people and their wealth was taken in what is now the Dominion of Canada in 1666, and that system was later copied by all the greater world nations? Read this article on census-taking in Canada and learn all about it.

"Neighbor's Wooing"
By Francis Dickie

A race-track story in which you can fairly hear the rhythmical hoof-beats of the contending horses as they pound around the course. There's a beautiful, scheming young woman in this story and some plot!

"The Slant-Eyed Man"
By Leslie Howard Gordon

This is the second in the series of "The Gates of Tien T'ze" stories. There's mystery here that keeps you guessing right up to the climax.

"Pawned"

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"Peacock's Pinnacle"
By M. O. Hammond

Here's the absorbing story of a director of the Bank of England who "was once a barefoot boy" in the hills of Glengarry. Read how this barefoot lad, who built castles in the air, and by dint of his own efforts, made every dream come true.

"The Legion of the Lost"
By J. L. Rutledge

Why do men disappear? Sometimes it's premeditated action on the part of the individual, committed for the same reason as suicide. At other times it's accident—and then again, there are grim disappearances that are never solved. In real life the long arm of coincidence often plays a role that baffles the detectives.

"Our Lower Prices Bogey"
By Charles Christopher Jenkins

Who's to be blamed for the falling off in demand for certain necessities? What caused the slump in wages in many lines of industry? Read this article in which is described the "Deadly Circle" to blame for the passing depression. The article includes a resumé of the situation from leading employers and labor leaders.

"Son of the Clackmannan Giant"
By Stanley R. Hofflund

Do you like prize-fight stories? Maybe you don't care for the brutal sort, but here's one that is different—of a prize-fighter with a soul and a woman at stake.

Review of Reviews

Included with this exceptional line-up of intellectual information and entertainment are the regular features of MACLEAN'S—the "Review of Reviews"—a comprehensive summary of the world's best contemporary short articles:

A British Spy in Soviet Russia
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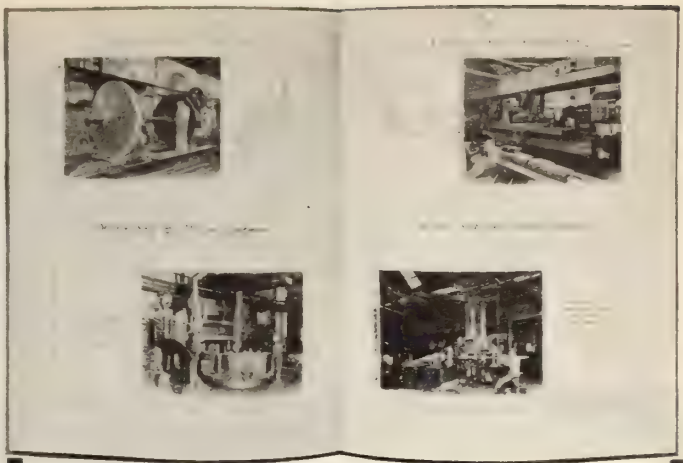

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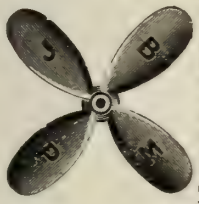

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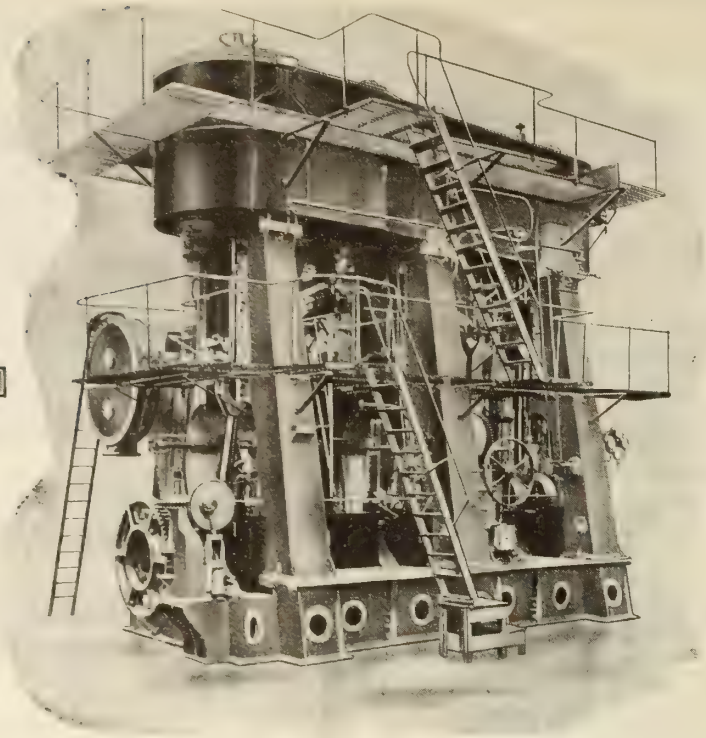

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Vol. XI. MAY, 1921 No. 5

The Machinery of the U.S.S. Tennessee

The First Battleship to be Fitted With Turbo-Electric Propelling Machinery—The Turbo Generators—Auxiliary Machinery Driven By Turbo Generators—The Propeller Motors—The Control Room

SINCE the U.S.S. Tennessee is the first battleship to be designed specifically for steam-electric propulsion (the New Mexico having been originally intended for turbine drive), her propelling equipment is of special interest. The general arrangement of her machinery is as follows:

Each turbine-generator unit with its exciters is located in a separate water-tight compartment, and its condensers, pumps, air ejectors and other auxiliaries in a compartment below. The four propeller motors occupy three water-tight compartments in the stern, the two inboard motors being in one, and an outboard motor in each of the other two. No other apparatus is in the motor compartments. The control room from which all of this machinery is controlled is also separate and water-tight, and is aft of the turbines and forward of the two inboard motors.

Turbine Generators

Each turbine-generator unit consists of a single Westinghouse steam turbine directly connected to a 3-phase alternating-current generator, rated at 15,000 kv-a for continuous operation and delivering 3,400-volt, 36-cycle current, at full speed.

The turbines are of the impulse-and-reaction type, and permit the complete expansion of the steam in each cylinder. They are designed to take steam at 250-lbs. gauge pressure at the throttle, 50 degrees superheat, and 28 1-2 inches vacuum. The steam, on entering the turbine, is first expanded in a set of nozzles, and then passes through a 2-row impulse wheel and through a high pressure reaction stage. It then divides, and the two parts pass through low pressure reaction blading on opposite ends of the rotor, and exhaust into the condenser.

The speed of the turbine can be varied over a range of from 1,500 to 2,200 r.p.m. by means of a manually-operated governor. This governor is of the centrifugal type, but instead of being loaded by means of a spring, it is loaded by hydraulic pressure, the fluid being oil. The pressure of this oil is regulated by a valve in the control room, so that the turbine speed can be controlled at will from this point. The speed of the turbine depends upon the setting of this valve and will remain constant for a given setting regardless of the load.

The turbine has also an over-speed governor which will automatically shut it down in case of excessive speed. This governor can be manually operated at the turbine or by a wire pull from the control room.

Generators.—The main generators, which are of Westinghouse make, are similar in design and construction to those used on land, except that special precautions have been taken to protect the windings from salt and moisture. The insulation is of the best known materials and is applied by thoroughly tried methods. Each coil was insulated by the vacuum-and-pressure method and then given several treatments of varnish and baked after each treatment. On completion, the entire winding was varnished and baked.

Ventilating air is blown through the stator coils by means of blowers mounted on the motors, which provide sufficient air to keep the windings cool under any condition. The air is drawn in at the bottom of the end bell, is forced axially through the machine, and is discharged radially through an opening in the top of the frame to ducts leading to the deck.

The rotor is of the totally closed type and is not ventilated internally. It is connected to the turbine by means of a flexible coupling which is enclosed in the bearing housing between the two machines.

The bearings of both the turbines and the generators are lubricated by oil under pressure from motor-driven rotary pumps. Should these pumps fail, similar pumps driven by steam turbines immediately start up automatically, so that no break will occur in the oil supply. Oil for the hydraulic governor is supplied from the same source.

Auxiliary Turbine Generators

In each engine room there are three 300 Kw. direct-current turbine-generators, which supply current for light for operating the various motor-driven auxiliary machines throughout the ship, and for exciting the generator fields.

The current for exciting the generator fields is automatically controlled by a small motor-generator "booster" set in each engine room. The motor of this set is driven by power from the auxiliary turbine-generators, and the generator of the set bucks or boosts the voltage of the field current to the value best suited to given operating conditions.

Pumps.—The main and auxiliary condensate circulating pumps, as well as the oil-cooler circulating pumps are motor-driven. The vacuum is normally maintained by air-ejectors, but as this is the first use of air ejectors for main condensers on a battleship, steam-driven air pumps are also installed.

The Propeller Motors

The four propeller motors are of the Westinghouse induction type, and each is rated at 8,375 horsepower at its maximum speed.

In order to provide two speed ranges, each motor can be connected so as to provide either 24 or 36 poles. The primary, or stator, has two independent windings, one for each pole arrangement; while the secondary, or rotor, has a single winding, with cross connections, which forms a polar winding terminating in three slip-rings with the 24-pole arrangement, and a squirrel-cage winding with the 36-pole arrangement.

The motors are operated at their lowest speed by connecting them for 36

poles and supplying them with power from the main generators operated at their lowest speed, so that for a ship speed of 10 knots, the motor speed is 78 r.p.m., and the generator speed is 1,430 r.p.m. To increase this speed, the speed of the generators is increased, and at the maximum generator speed, the motor speed is 118 r.p.m. and the ship speed 15 knots. To still further increase the ship speed, the motors are connected for their 24-pole winding, and by again varying the generator speed, a range of motor speeds of from 118 to 180 r.p.m. is obtained, and the speed of the ship is increased from 15 knots to maximum. One turbine generator gives sufficient power up to about 17 knots, while above that speed both are required. This arrangement gives a wide speed range, and at the same time makes it possible to obtain efficient operation of the turbines for both low cruising speeds and full speeds.

The construction of the motors follows standard land practices, with special insulation similar to that of the generator windings. The frames are of the self-contained type, with bearings supported by brackets, and the whole weight of 130,000 pounds is born by feet cast integral with the frame. The bearings and housings are readily adjustable by means of jack screws in the brackets, and are lubricated by oil under pressure.

The motors are ventilated by means of duplicate motor-driven exhaust blowers mounted on top of each motor. Each blower has a capacity of 12,500 cubic feet of air a minute, and draws air through the cores and windings, and discharges it into ducts to the deck. These blowers are assisted by fan vanes on the rotors of the main motors, which can supply sufficient air to permit the motors to be operated at full load for short periods even if the exhaust blowers fail.

A small direct-current motor is geared through a clutch to each propeller shaft and is used to turn the motor-rotor and the propeller slowly for inspection or repair.

The Control Room

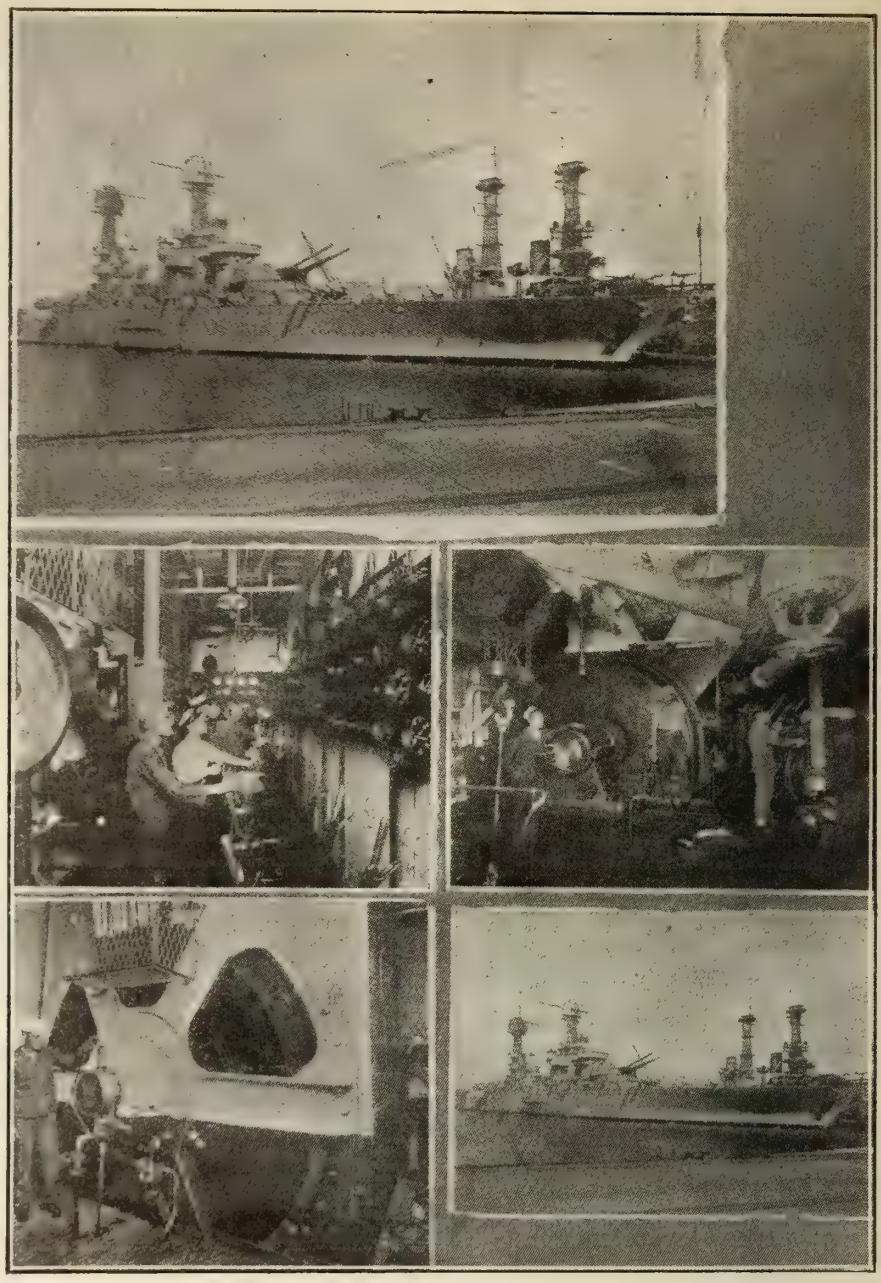
All of the apparatus necessary for controlling the propelling machinery is located in the control room. The switches are mechanically operated by means of levers, which are arranged in a row down the centre of the room. All of these levers are mechanically interlocked so that it is impossible to close or open wrong switches. Facing these levers, in plain sight of the operators, is a set of meters giving full information as to the operation of the machinery and the condition of the various circuits.

All of the switches handling the main high-voltage current are of the oil-break type and are capable of being opened safely under full load and voltage, although normally they will not be so opened. The majority of the switches are located in a structure in front of the control board, where they are fully safeguarded with covers but are easily accessible. A special device has been built, by means of which the oil tanks of the switches can be easily lowered so as to expose the contacts. A system of electrical interlocks and disconnecting devices protects the men against possibility of faulty operation, and also makes it possible to render safe for inspection the circuits of any one or two motors while the others are in operation.

The rheostats, used in bringing the rotors up to speed when their 24-pole windings are in use, are of the liquid type and are located in the control room behind the control levers. In this type of rheostat, the resistance of the circuit is varied by raising or lowering the level of a solution of sodium carbonate in which electrodes, connected with the leads from the motor secondary circuits, are immersed.

The switches are arranged so that either generator can operate any or all of the motors, and so that the port and the starboard motors can be run in opposite directions, if desired. When both generators are used, each drives two motors, and the two systems are independent.

All of the main turbines, generators, motors, and control equipment, the auxiliary turbo-generators, air ejectors, circulating and condensate pumps, and the motors for operating the steering gear and deck winches were manufactured by the Westinghouse Electric & Manufacturing Company.



TOP—THE U.S.S. "TENNESSEE."
MIDDLE LEFT—THE CONTROL ROOM.
MIDDLE RIGHT—ONE OF THE MAIN ENGINE ROOMS.
BOTTOM LEFT—ONE OF THE 8,000 H.P. MOTORS.

LLOYD'S REGISTER SHIPBUILDING RETURNS

For the Quarter ended December 31, 1920

THE merchant tonnage returned as under construction in the United Kingdom at the end of March, 1921, amounts to 3,798,593 tons. In normal times this total would indicate great activity and prosperity in the shipbuilding industry; but the times are not normal and the total as it stands is misleading because it does not represent the work actually in progress, and therefore does not afford a true index of the relative position of the shipbuilding industry as compared with, say, twelve months ago.

It includes a considerable amount of tonnage on which work has been suspended owing to the very heavy reduction in shipping values corresponding to the rapid and serious fall in freights, and consequent decline in the demand for tonnage. It also includes a large quantity of tonnage, the completion of which has been postponed owing, principally, to the joiners' strike. The tonnage on which work has been suspended amounts to 497,000 tons, and the tonnage the completion of which has been delayed amounts to 350,000 tons. These two totals, amounting to 847,000 tons, must therefore be deducted from the tonnage under construction in order to enable a comparison to be made with the figures for normal times, and we thus arrive at a reduced total of 2,951,593 tons under construction in the United Kingdom.

As compared with the figures for the quarter ended December, 1920, there has been a large reduction (146,000 tons) in the tonnage launched during the past quarter.

Attention was called in the last quarterly return to the fact that although the total tonnage returned as under construction was so large, the amount completed compared very unfavorably with that of pre-war times. It was pointed out that whereas in 1913 the average tonnage completed during each quarter was over 23 per cent. of the total work in hand at the beginning of the quarter, the corresponding figures for 1920 fell below 13 per cent. There is a still further reduction in the past quarter, the output having fallen as low as 8 per cent.

There has also been a considerable reduction (113,000 tons) in the tonnage commenced during the past quarter; and in this connection it is significant to find that as regards the tonnage in preparation but not commenced there is a drop of 75 per cent. as compared with a year ago.

The total merchant tonnage building abroad is 3,288,173 tons; and it may be noted that, unlike the returns for the United Kingdom, those for abroad are not subject to any material reduction on account of suspended or delayed work, of which there appears to be comparatively little in other countries. Indeed, the gross figures given in the present Quarterly Return of tonnage building abroad can be fairly compared with those shown for recent years.

It will be seen that the tonnage is about 183,000 tons lower than the total building at the end of December, 1920, due to the continued decrease in the United States of America, in which country the tonnage now under construction is less than 27 per cent. of the total building there two years ago.

Apart from the United States, the leading countries abroad are: France with 427,186—an increase for the quarter of about 30,000 tons; Holland, 417,693 tons; Italy, 351,639 tons; and Japan, 294,346 tons, an increase of 46,000 tons.

The returns show that there are at the present time 187 steamers and motor-vessels each of over 1,000 tons with a total tonnage of 1,320,193 tons, under construction for the carriage of oil in bulk. Of the total, 84 of 557,027 tons are under construction in the United Kingdom, and 82 of 632,016 tons in the United States; the latter figure representing over 57 per cent. of the total tonnage now under construction in that country. The tonnage of vessels under construction which are to be fitted with internal combustion engines amounts to 503,842 tons.

Merchant Vessels Under Construction

The returns compiled by Lloyd's Register of Shipping, which only take into account vessels of 100 tons gross and upwards the construction of which has actually been commenced, show that there were 884 merchant vessels of 3,798,593 tons gross under construction in the United Kingdom at the close of the quarter ended March 31, 1921. The particulars of the vessels in question are as follows, similar details being given for the preceding quarter, for the purpose of comparison:—

Description	Mar. 31, 1921 No.	Mar. 31, 1921 Gross tns.	Dec. 31, 1920. No.	Dec. 31, 1920. Gross tns.
Steam—				
Ferro-Concrete	...	.....	2	1,494
Steel	790	3,528,190	822	3,470,932
Wood & Composite	4	2,173	5	2,429
Total	794	3,530,364	829	3,474,855
Motor—				
Steel	60	260,731	54	225,960
Ferro-Concrete	4	2,094	2	600
Wood & Composite	2	355	1	450
Total	66	263,180	57	227,010
Sail—				
Steel	23	4,749	35	7,051
Ferro-Contrete	...	.....	...	.....
Wood & Composite	1	300	...	.....
Total	24	5,049	35	7,051
Total Steam, Motor, and Sail	884	3,798,593	921	3,708,916

The tonnage now under construction in the United Kingdom is about 90,000 tons more than that which was in hand at the end of last quarter, and about 404,000 tons more than the tonnage building 12 months ago. These figures, however, do not represent the work actually in progress. The total now returned as under construction includes 497,000 tons on which work has been suspended. It also includes 350,000 tons the completion of which has been postponed, owing principally to the joiners' strike. These two totals amounting to 847,000 tons, must therefore be deducted from the tonnage under construction, for the purpose of comparison with normal figures, thus reducing it to 2,951,593 tons.

The March figures include 84 steamers and motor vessels of 1,000 tons and above, with a total tonnage of 557,027 tons, intended to carry oil in bulk.

Of the merchant vessels being built in the United Kingdom at the end of March, 696 of 3,031,412 tons are under the inspection of the surveyors of Lloyd's Register with a view to classification by this society.

Merchant Vessels Under Construction in the World.

Where Building		No.	Gross tns.
United Kingdom	†	794	3,530,364
	‡	66	263,180
	§	24	5,049
*Other Countries	†	754	2,981,925
	‡	128	240,662
	§	139	65,586
Total for the World	†	1,548	6,512,289
	‡	194	503,842
	§	163	70,635

*Excluding Germany, figures for which country are not yet available.
†Steam. ‡Motor. §Sail.

The tonnage being built in the world at the end of March under the inspection of the Surveyors of Lloyd's Register, excluding vessels the construction of which has not actually been commenced and excluding all vessels of less than 100 tons, amounts to 4,738,955 tons.

Work in Hand in Principal Districts

The following table gives the total figures for vessels now under construction in the principal shipbuilding districts of the country, as compared with those for the previous quarter. Each district of course includes places in the neighborhood of the port after which it is named.

District		Mar. 31, 1921 No.	Mar. 31, 1921 Gross Tonnage	Dec. 31, 1920 No.	Dec. 31, 1920 Gross Tonnage
Aberdeen	§	18	19,219	16	16,340
	†	1	150	1	450
Total		19	19,360	17	16,790
Barrow, Maryport and Workington	§	11	102,473	11	118,673
	†	5	34,445	5	34,445
Total		16	136,918	16	153,118
Belfast	§	48	399,580	48	350,020
	†	2	11,600	2	11,600
	‡	..	.....	..	.....
Total		50	411,180	50	361,620

Clyde—					
Glasgow ....§	174	868,911	165	842,986
†	22	138,930	17	113,045
‡	8	1,436	16	3,316
Total	204	1,009,277	198	959,347
Greenock ....§	58	301,887	62	311,141
†	5	34,700	5	34,700
‡	..	.....	..	.....
Total	63	336,487	67	345,841
Dublin .....§	12	15,845	13	17,725
Dundee .....§	23	71,240	23	64,790
†	2	600	2	600
Total	25	71,840	25	65,390
Hartlepool .....§	22	106,300	20	97,960
Hull .....§	30	74,107	43	71,218
†	1	227	2	387
‡	..	.....	..	.....
Total	31	74,334	45	71,605
Leith .....§	18	39,553	23	52,893
†	1	3,845	1	3,845
Total	19	43,398	24	56,738
Liverpool .....§	46	114,357	54	123,219
†	8	2,612	7	1,218
Total	54	116,969	61	124,434
Londonderry ..§	5	31,800	4	26,800
Middlesbro', §	52	231,181	60	281,031
Stockton and ‡	..	.....	..	.....
Whitby				
Total	52	231,181	60	281,031
Newcastle .....§	126	697,871	122	650,431
†	5	12,081	4	7,681
‡	2	800	..	.....
Total	133	710,752	126	658,112
Newport, Mon. .§	4	16,196	5	22,696
‡	5	913	2	460
Total	9	17,109	7	23,156
Southampton ..§	29	62,041	32	59,996
†	6	1,480	3	750
‡	..	.....	..	.....
Total	35	63,521	35	60,746
Sunderland ....§	66	323,865	66	311,610
†	3	15,510	3	15,510
Total	69	339,375	69	327,120

§Steam. †Motor. ‡Sail.

The three tables which follow give further details of the work in United Kingdom yards; the fourth presents statistics of work abroad. In connection with the latter, it is of interest to note that at the end of March there were under construction abroad 103 steamers and motor vessels of 1,000 tons and above, with a total tonnage of 763,166 tons, intended to carry oil in bulk. Of these vessels 82, of 632,016 tons, were building in the United States of America.

Vessels Under Construction for Abroad. Other Details.

Country for which intended	No.	Gross tons
British Dominions	18	87,720
Belgium	5	17,060
Denmark	7	25,775
France	58	295,298
[illegible]	7	23,230
Holland	26	210,708
[illegible]	5	63,300
Japan	4	25,200
[illegible]	71	241,381
South America	11	27,545
[illegible]	15	46,600
Sweden	2	10,340
United States	5	28,411
Other Countries	2	4,750
Total	236	1,108,318

The following details concerning the shipbuilding work of the United Kingdom during the past three months may be added:

During Quarter ended March 31, 1921		No.	Gross Tons
Vessels commenced	§	83	355,933
	†	10	35,460
	‡	6	1,484
Vessels launched	§	113	400,573
	†	8	30,690
	‡	10	2,344

§Steam. †Motor. ‡Sail.

Size of Vessels Under Construction

The following table shows the vessels under construction in the United Kingdom classsified according to gross tonnage: ....

Gross tonnage			Number Steam	Motor	Sail
*100 and	under	500.....	92	21	24
500	"	1,000.....	105	2	..
1,000	"	2,000.....	86	6	..
2,000	"	3,000.....	76	1	..
3,000	"	4,000.....	69	3	..
4,000	"	5,000.....	51	2	..
5,000	"	6,000.....	89	5	..
6,000	"	8,000.....	109	17	..
8,000	"	10,000.....	54	9	..
10,000	"	12,000.....	4	..	..
12,000	"	15,000.....	28	..	..
15,000	"	20,000.....	25	..	..
20,000	"	25,000.....	5	..	..
25,000	"	30,000.....	1	..	..
30,000	"	40,000.....	..	..	..
40,000 tons	and	above	..	..	..
	Total	.....	794	66	24

*Vessels of less than 100 tons are not included in Lloyd's Register Shipbuilding Returns.

Merchant Vessels Under Construction Abroad

Countries	Steamers and Motor Vessels Steel No.	Steel Gross Tons.	Wood No.	Wood Gross Tons.	Sailing Vessels. Steel No.	Steel Gross Tons.	Wood No.	Wood Gross Tons.	Total No.	Total Gross Tons.
America—										
United States—										
Atlantic Coast	94	719,829	..	.....	7	3,706	11	9,400		
Gulf Ports	18	94,017	3	1,560	..	....	1	400		
Pacific Coast	35	265,900	1	2,200	..	....	1	2,260	174	1,102,672
Great Lakes	3	3,400	..	....	..	....	..	....		
British Dominions—										
Canada—										
Coast	28	102,530	3	1,057	..	....	6	6,960		
Australia	6	20,059	..	....	..	...	2	3,580	72	180,402
Hong Kong	11	26,395	..	....	2	910	..	....		
Others	2	1,415	3	1,150	..	....	2	325		
Belgium	9	26,725	..	....	..	....	..	....	9	26,725
Brazil	1	2,170	..	....	..	....	..	....	1	2,170
China	11	35,098	..	....	3	630	..	....	14	35,728
Denmark	53	122,442	1	450	..	....	1	380	55	123,272
Esthonia	3	1,650	3	575	..	....	12	3,025	18	5,250
Finland	6	6,006	4	1,305	..	....	3	980	13	8,291
France	102	418,584	..	....	8	7,285	5	1,317	115	427,186
Greece	1	900	1	600	..	....	..	....	2	1,500
Holland	168	415,893	..	....	5	1,800	..	....	173	417,693
Italy (including Trieste)	65	327,231	40	14,837	..	....	33	9,571	138	351,639
Japan	59	294,346	..	....	..	....	..	....	59	294,346
Norway	54	85,977	7	1,486	2	475	..	....	63	87,938
Portugal	..	.....	8	3,523	..	....	29	10,856	37	14,879
Spain	24	97,101	1	800	..	....	1	150	26	98,051
Sweden	42	107,825	5	1,530	1	661	4	915	52	110,931
Total	802	*3,191,514	80	31,073	28	†15,467	111	50,119	1,021	3,288,173

*Including 2 ferro-concrete vessels of 2,868 tons. †Including 5 ferro-concrete vessels of 5,000 tons.

The following little poem, printed in "Punch," will carry an appeal to most seafarers, whether they have ever been in Surrey Commercial Docks or not. The site of these famous docks it appears was once known as Lavender Pond, and thence the poet gets his inspiration. Even those who are not seagoing cannot help but enjoy the sweet rhythm of the lines.

LAVENDER POND

Surrey Commercial Docks
(Punch)

Never a swallow wets his wing
In Lavender Pond from spring to spring;
Never a lily, pure and chill,
Holds her cup for the dews to fill;
Never a willow, gnarled and hoar,
Bends his boughs to a weedy shore;
Never a fragrant flower-spike blows there,
Never a lordly king-staff grows there,
Slender and straight where sedges shiver
And glistening Mayflies glance and quiver,
In Lavender Pond by London River.
But the Baltic barques they come and go
With their old pump-windmills turning slow,
And the tall Cape Horners rest and ride
Like stately swans on the murky tide,
And the ocean tramps all red and rusted,
Worn and weathered and salt-encrusted,
Gather and cluster near and far,
Derrick and funnel, mast and spar,
From many a port of old renown,
And lonely wharf where the booms float down,
To Lavender Pond by London town.
And keen and strong is the wind that comes
To the dingy streets of the Deptford slums,
Strong and keen with the scene it steals
Off piled-up acres of Kalmar deals,
Spruce and cedar and baulks of pine,
Red with resin and drenched with brine,
Sawn from the boles that once did stand
Rank on rank in a virgin land,
Where the cougar prowls through the silent glades
In the forest depths of the far Cascades
And the gulls go flying, the gulls go crying,
And the wind's sobs and the water's sighing
Croon to the ships on old sea ditty
In Lavender Pond by London city.

The Auxiliaries of Oil Engined Vessels

The Alternative Means of Supplying Power to the Auxiliaries, Steam or Oil—Gasoline or Kerosene?—Fuel Costs of Oil and Steam Winches—Steering Gear and Winch Arrangements*

By WALTER POLLOCK

THE problem of auxiliary machinery presents greater difficulties with oil-engined vessels than with steamers. With the latter, either the donkey boiler or the main boiler supplies all the steam necessary for the capstan right aft, the windlass right forward, and all the other auxiliary machinery in between. When one thinks of the price of coal in these days, and the appalling inefficiency of steam winches, the steam windlass, steam steering gear, and the steam capstan, etc., one wonders why such extravagance is still permitted. The simplicity of the steam auxiliaries and their reliability is probably the reason, but when the waste due to condensation in the long lengths of steam pipe and the general wastefulness of the average steam winch are taken into consideration, it surely only requires a well-tested oil engine that can work in the open and prove itself reliable to make steam auxiliaries obsolete.

We should first consider the alternative methods of powering the auxiliaries, then the methods available, together with the advantages and disadvantages and notes concerning their installation and working. The powering methods on all vessels must depend upon coal or oil, and the author will endeavor to show that the latter is much more economical, and with proper engineers the best makes of oil engines are equally reliable.

Powering by steam means, of course, a donkey boiler, unless the extravagant main boiler is used, and should the former method be adopted, even with an oil-fired boiler, it should be fitted in a separate engine-room for reasons of cleanliness. The only advantage of the donkey boiler is that anybody can work it, and there is considerable flexibility in the steam winches and auxiliaries. The advantages of the surface ignition or hot-bulb oil engine are that it can use cheap fuel oil, is very economical to run, has no loss by condensation in steam pipes, has no stand-by losses, the fuel is handled more easily than coal, and the whole installation with oil engines is about one-third the weight of the steam plant, this latter point increasing the amount of cargo carried and freight earned.

Oil engines using paraffin or petrol for fuel are only used for small auxiliaries. Petrol is usually dangerous if used on board a ship, and paraffin is more expensive than the fuel oils used by surface-ignition or hot-bulb oil engines.

If powering by oil engine is adopted it means:

(a) A separate engine for each machine, or

(b) A generating station in the main or auxiliary engine-room for the whole ship, or

(c) A combination of (a) and (b).

The separate engine is practicable for each air compressor, winch, capstan, windlass, pump, and the electric light, but not so convenient for the steering gear. A very efficient and economical method of driving the winches is to have an oil engine in a deckhouse between the hatchways, suitable for driving, say, four or six winches at a time, as shown in Fig. 2.

Fuel Costs of Oil and Steam Winches

One-Ton Bolinder-Reid Winch

(8 h.p. Bolinder Engine)

Fuel per week of 50 hours at 6 pounds per hour equals 300 pounds per week.

Say 34 gallons costing 1s. 4d. per gallon equals say £2 5s. per week.

One-Ton Steam Winch

(10 h.p. Engine)

Coal per week of 50 hours at, say, 4½ pounds per h.p. per hour, plus 1½ pounds for condensation equals 3,000 pounds.

Say 1 ton 7 cwt. of coal per week at 77s. 6d. per ton equals £5 3s. 6d.

The above shows a saving of £2 18s. 6d. per 50-hour week in favor of the oil engine driven winch. As previously mentioned, the first cost of the steam winch is less than that of an oil engine driven winch, but, in addition to the saving by fitting the latter, a considerable saving is also effected by the abolition of the boiler, with its consequent stand-by losses. It should be borne in mind that no packing of glands is required on the oil engines, whereas steam winches require a fair amount of attention in this respect if they are to be maintained in an efficient condition.

A central generating station can power the whole of the auxiliaries by supplying electricity or compressed air; the former is a strong favorite, although the latter could in some cases be used with advantage, especially for the steering gear. The advantages of the "separate engine" are the well-known individual unit, the absence of stand-by losses, and the highest possible economy of fuel, as only the power actually required is used, and on the spot where wanted. The disadvantages are the greater initial cost of the large number of oil engines required and the increase in cost of installation due to the necessary water-cooling connections.

At the present time a two-ton oil-engined winch costs twice as much as a two-ton steam winch. As more experience is obtained with the former, and as the demand and production increase, the cost will be reduced, although an oil engine will always cost more than a steam engine (without a boiler), because the materials and the workmanship are much more expensive. In considering the relative cost of oil-engined and steam winches and auxiliaries, it is necessary to bear in mind that the steam plant requires a boiler, which entails considerable cost and weight.

Electrically-driven auxiliaries have also the disadvantage of heavy first cost, because a powerful oil-engine coupled to a dynamo is necessary in the engine-room, and it is difficult to get one to work economically with the varying demands on board ship. Where there is space, as there usually is in large vessels, it is best to divide the generating system into two or three units, so that one or more can be in use as required, the aim being to keep each generator as near full load as possible. This is much more economical in operating costs than having one big oil-engine generator running at half or less load for most of its time, and is a safeguard against total breakdown of the electrical system in the event of mishap to engine or dynamo. An advantage is that no steam is being taken from the boilers, as in the case of steam auxiliaries.

The advantages of powering by electricity are its great convenience and flexibility and the fact that practically all the machinery is under the eye of the engineer in the engine-room.

Steering Gear and Winch Arrangements

Economy lies in the direction of the oil-engine only where it is practically possible. Dividing oil-engined vessels into three sizes, the following would appear to be the most satisfactory lay-out for the auxiliaries:

(1) Vessels up to 400 tons D.W. to have hand steering gear, oil-engine winches, the forward one to work the windlass by a messenger chain, a combination set in the engine-room to operate the pump, the air compressor, and, if necessary, a belt-driven dynamo for lighting.

(2) For vessels from 400 to 1,500 tons D.W., some form of mechanical steering gear is necessary. Probably the most economical would be an electric generating station for the steering gear, winches, capstan and windlass, although in a number of vessels hand steering is accepted, even up to 700 or 800 tons D.W., in which case the previous suggestion would probably be adopted.

(3) Vessels above 1,500 tons D.W. would no doubt have electric-hydraulic

*Extract from a paper read at the Institute of Marine Engineers.

steering gear fitted direct to the rudder head, the power being supplied from an electric plant in the engine-room, the winches and windlass also being driven by electric power.

In large motor tank ships a boiler is required for steaming the cargo tanks, in which case possibly it is advantageous to have capstans and windlass steam driven as well as a steam-driven air compressor. Usually the steam is only required when the cargo is being discharged in the case of very viscous oil, such as cocoanut oil or heavy fuel oil. Therefore, if the boiler is lighted up just before arriving at port of discharge, the steam is ready for capstan and windlass. The Cochran type of boiler is very suitable for this purpose. In a case like this, the steering gear and other auxiliaries would be electric, so as to avoid the necessity of using the boiler when at sea. In large vessels, especially those trading in northern latitudes, a boiler of some kind is necessary for heating the accommodation, as electric heating is somewhat expensive.

If a boiler is fitted, it should not be in the engine-room when the main and auxiliaries are driven by oil engines, but in a separate compartment.

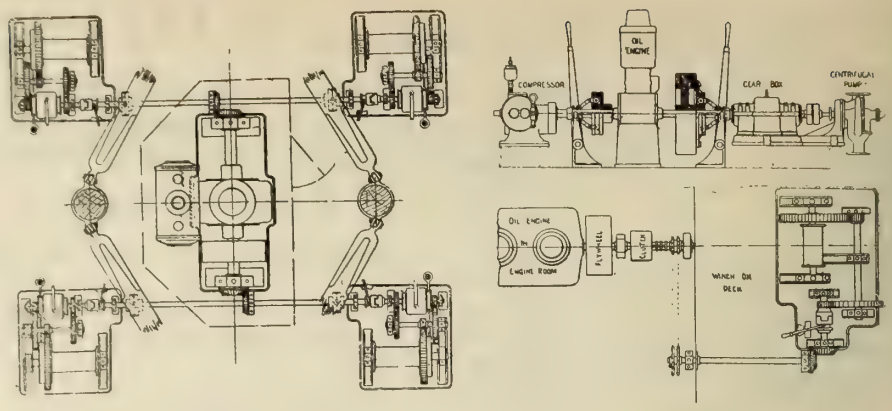
For oil-engine-driven electric lighting and electric generating sets, it is advisable to have a self-contained unit with an oil-engine using similar oil to that used in the main engines.

The general question of lighting by electricity is the same for all sizes of vessels. The bilge pumps for most vessels can be driven off the main engines; as an auxiliary bilge pump is required for all classed vessels, a separate engine is necessary, which can be arranged by having an oil-engine using where possible similar fuel to that used in the main engine, but direct-coupled to the bilge pump on one end, and having a stand-by or auxiliary air compressor at the other end. This pump may then be used for general purposes, such as filling and emptying ballast tanks, washing decks, and sanitary purposes. This general idea is seen in Fig. 1.

In very small vessels an economical method of driving auxiliary pumps, air compressors, or even electric lighting sets can be arranged with a belt or chain from the main engine shaft, and, instead of having tripping gear, it is better to arrange for the belt to be tightened up by a "jockey" pulley, and, when not in use, to be taken off the belt wheel on the shaft and suspended ready for use.

Fig. 3 illustrates a method of driving the cargo winch from the main engine, when the winch is placed at the after end of hatch in small coasting vessels with engines placed aft.

For small tankers, the plunger pumps for discharging cargo can be driven very economically. If the pump is fitted on the main deck near the engine-room, the pump can be driven from the propelling engine like the winch in Fig. 3. An alternative method is to fit an auxiliary oil-engine on deck in a deck-house with a clutch to connect it to the cargo pump on one side and to a shaft line on the opposite side. This shaft line could have a warping drum on the extreme end outside the casing for warping the ship in and out of dock. It would also drive a bilge pump for bilge and wash deck purposes, and, by a belt, could drive a dynamo for electric lighting, etc.



FIGS. 1, 2 AND 3.—TYPES OF AUXILIARY MACHINERY.

In the case of auxiliary sets being fitted on some oil-engined tugs for the Thames, the compressor is direct-coupled to a surface ignition engine, running at 600 r.p.m., through a friction clutch, a centrifugal pump being similarly driven at 2,000 r.p.m. through a gear box.

A method that has frequently been adopted with vessels up to 500 tons deadweight is to have a friction clutch to connect and disconnect the drive from the forward end of the engine flywheel. By this means the air compressor on one side and the bilge pump on the other can be driven when required and can be disconnected when not in use. This method appears to be preferable to having a crank pin extension permanently connected to the flywheel at the forward end of the engine for driving either an air compressor or the air compressor and bilge pump combination.

Salvage pumps that require to be self-contained units for lifting on board wrecks and sunken vessels will be handier, more portable, more convenient, and more economical if fitted with an oil-engine than if fitted with the cumbersome steam boiler.

Working Costs

The cost of working is the most important point when competition is keen and severe. In this respect, the oil-engine will always show to advantage, and in the future to even greater advantage, as the cost of the cheaper oil fuels will be reduced as the supply of oil tankers increases. On the other hand, coal will not see the same proportionate reduction. The economy in working has been shown quite recently by a 20 b.h.p. oil-engine which was doing the work of a steam-engine at one-third the cost. The author knows of many cases where the oil-engine is today working at one-half the cost of steam machinery.

A method adopted by the Admiralty on several of their oil tankers in use during the war, fitted with twin sets of 320 b.h.p. Bolinder four-cylinder engines for propelling purposes, was briefly as follows:

At the forward end of each main engine, a length of shafting was connected through a friction clutch to a Hayward-Tyler two-throw reciprocating pump, this pump having single reduction gearing to reduce the revolutions to enable the pump to deal with the thick fuel oil. When these pumps were in action the after clutch (for the propeller) was, of course, disengaged. Only two cylinders of one engine were required to drive the pumps. To ensure all the bulbs being kept at a sufficiently high temperature to enable the vessel to get under way instantly, the load was changed occasionally from one pair of cylinders to the other pair. This method worked very successfully.

An interesting and simple pumping arrangement fitted on a 300-ton oil tanker fitted with twin 120 b.h.p. two-cylinder Bolinder engine is as follows: At the forward end of the port engine crankshaft a sprocket wheel is fitted, which drives, by means of a roller chain, a horizontal ram pump placed on the starboard side of the deck, thus giving the chain a diagonal lead. A "jockey" wheel is also fitted on the slack side of the chain, to ensure alignment. When at sea, the roller chain is removed, thus dispensing with the necessity of a clutch. This drive has been in use nearly eight years, and has given no trouble whatever.

The installation and working of auxiliaries will be dealt with in another paper.

Quebec.—A party of Dominion senators, who are visiting some of the Dominion ports, arrived at Quebec early in May and were taken around the harbor by the Commissioners. It was pointed out to the visitors that the great grain elevators capable of holding 2,000,000 bushels, were very seldom used. This was on account of the grain being shipped through American ports.

THE strike of marine workers in United States ports has resulted in bringing considerable business to British Columbia ports that otherwise would have been handled south of the boundary. Vancouver has benefited more than any other port and considerable quantities of freight have been lightered there and loaded on steamships for trans-shipment overseas. Practically all American companies operating vessels out of Seattle and other Puget Sound ports have been forced to suspend sailings, although the Pacific Steamship Co. has managed to sign up crews for a few of its vessels. The Silver State and Keystone State, two United States Shipping Board vessels recently acquired by this company, will leave shortly for this coast, manned by full crews. They will be engaged in the Oriental trade.

* * *

Three ships of the Canadian Government Mercantile Marine, which will ply between Vancouver and San Francisco, are now on their way out from Montreal and will inaugurate the service July 1, according to B. C. Keeley, in charge of the C. G. M. M. affairs on this coast. The ship which will make the initial passage is the Canadian Beaver. The other ships on the run will be the Canadian Farmer and the Canadian Rover. The steamships were built at the Collingwood Shipbuilding Co. plant and are of about 4,000 tons. Mr. Keeley has announced that the Canadian vessels will carry pulp and paper from Ocean Falls, B.C., to California after this, as better terms were offered than the Pacific Steamship Co. was able to give.

* * *

The Canadian Pacific Ocean Services has purchased the former German liner Kaiserin Augusta Victoria, 24,581 tons, and the Prinz Frederick William, 27,082 tons. The latter will be renamed the Empress of China and placed in the run between Vancouver, Victoria, Yokohama and Hongkong. The original Empress of China was wrecked in Japanese waters several years ago.

* * *

The steamship Prince Rupert, operated by the Grand Trunk Pacific, which was wrecked in Swanson Bay September 28, has been returned to her owners by Yarrows, Ltd., the Esquimalt ship repair firm. It was one of the biggest repair jobs ever handled by the company, practically the whole of the vessel having to be overhauled and patched up and new interior fixtures installed. At one time 700 men were employed in the work.

* * *

During the last few weeks there has been a heavy movement of lumber to Japan from British Columbia. This is largely in anticipation of the increase in rates from $10 to $12.50 a thousand, which will take effect July 1. The trans-Pacific lumber rate has been a rather uncertain factor and there has been a good deal of speculation on it. About two months ago the rate was brought down to the $10 level and much business was done. Just what the result of the increase will be is an open question. Ocean freights as a whole are pretty weak. Shipments of British Columbia lumber through Panama Canal continue in large volume. While the reduction in rail rates increased land shipments to some extent, there must be a further reduction of more than $3 a thousand before they will be on a level with the water charges.

* * *

Steamships of the Canadian Government Mercantile Marine have been taking the cream of the lumber trade between this province and Australia, and American sailing ship charters have suffered as a result. Sailers to Australia can be chartered at $17 to $17.50.

* * *

New manganese propeller blades are being manufactured for and installed in a large number of ocean steamships by the firm of Yarrows, Ltd., Esquimalt, the last vessel to be so equipped being the Imperial Oil Co.'s tanker Talaralite, which left Victoria recently for the Peruvian coast.

* * *

The Canadian Voyageur will be the first ship of the Canadian Government Mercantile Marine, Ltd., to commence the service between British Columbia ports and Montreal, according to announcement of B. C. Keeley, general agent of the company on this coast. The Canadian Voyageur is now on her way up the coast with a cargo of sulphur from Texas. She will precede the Canadian Carrier, which will steam from Iquique to Honolulu before coming on to British Columbia. Outbound, the Canadian Voyageur is scheduled to sail May 15, and the Canadian Carrier will move out ten days later. The Voyageur will carry a lumber cargo and will ship this mainly at Chemainus and other Vancouver Island ports. The Canadian Voyageur is a product of the Vickers shipbuilding plant at Montreal.

* * *

The old schooner Saucy Lass, for a long time owned by Captain Victor Jacobsen, of Esquimalt, who was one of the sealing fleet leaders years ago, has been purchased by Stanley Menhinick, A. A. (Buck) Taylor and Alex. Alliott, three young men of Victoria, who propose to make a voyage of indefinite duration to the South Seas "as far away from civilization as possible." All three men have had seafaring experience and Taylor and Alliott served in the war with the Canadian infantry and the Royal Naval Reserve respectively. The Saucy Lass will be rechristened the Karma and it is now being outfitted for the romantic voyage.

* * *

The steel ship Canadian Scottish, being built at Prince Rupert for the Canadian Government Mercantile Marine, Ltd., will be launched May 12. Mrs. C. W. Peck, wife of Lieut.-Col. Cyrus Peck, member of Parliament for the Skeena, will act as sponsor. The steamship's name was originally Canadian Reaper, but it was changed to commemorate the famous British Columbia battalion which Col. Peck, who is a Victoria Cross winner, led in action overseas. The other steamship being built by the Prince Rupert yards will probably be named the Canadian Fisherman in view of the dominance of the fishing industry in Prince Rupert.

* * *

The suit of Teers and Anderson against the Blue Funnel (Holt) Line for $6,000 damages as a result of the collision of the liner Tyndareus with a shingle crib owned by the plaintiffs last August has been dismissed by the British Columbia Admiralty Court.

* * *

A rate basis of $20 a ton for general cargo is understood to have found favor with the majority of delegates to a conference recently held between British Columbia shipping men held for the purpose of establishing a uniform rate basis between British Columbia ports and Manila, Singapore, Colombo and Suez. Companies represented at the conference

were the Canadian Robert Dollar Co., Canadian Government Mercantile Marine, Ltd., Pacific Steamship Co. and the Blue Funnel line.

* * *

Captain Daniel George Macaulay, well known sealing skipper and for thirty-five years resident in Victoria, died a few days ago, aged sixty-two. He was a native of Cape Breton and came to British Columbia in 1888 on the schooner Aranaugh by way of the Straits of Magellan. For some time he was engaged in steamboating on the British Columbia coast and served on the steamers R. P. Rithet, Yosemite, Fly and Maude. In 1890 he became associated with the sealing industry and retained his connection until 1907. He was master of several well-known sealing craft, including the Beatrice, Director and Penelope. He became interested in the whaling business in 1907, and spent several seasons whaling off the coast of Vancouver Island, retiring in 1912. He returned to active service in 1917 as master of the tugboat Lornet and was awaiting the recommissioning of this vessel after the winter tie-up when he died.

* * *

The Canadian naval squadron composed of the light cruiser Aurora and the destroyers Patriot and Patrician will remain at Esquimalt until May 28, and will then return to Halifax by way of the Panama Canal.

* * *

The Pacific Steamship Co. has decided to inaugurate a weekly California freight service between British Columbia ports, Seattle, San Francisco and Wilmington, commencing April 21. The Admiral Schley and Admiral Dewey will be used in this new service. The company has decided to eliminate the Mexican service now maintained by the Admiral Farragut and Curacao, although this may be resumed later when business improves.

* * *

The Dutch freighter Moerdyk, the first vessel of the Holland-Amerika Line to call at this port since the inauguration of the company's service from Europe to the Pacific coast, docked here recently. The Moerdyk is one of the fleet of four ships placed on this route last fall by the Dutch line. Her sister vessels are the Eemdyk, Kinderjikh and Nooderdyk.

* * *

The resumption of the service to the Pacific coast of the Royal Mail Steam Packet Line has been temporarily halted by strikes prevalent in Great Britain, but it is expected that the new steel ships will be delivered in the near future. The Royal Mail Line services to the Pacific were disrupted early in the war. The company has entered into an agreement to work in conjunction with the Holland-Amerika Line.

* * *

The Empress of Asia, owned by the Canadian Pacific Ocean Services, set up a new record for the trans-Pacific run a few days ago when she steamed from Yokohama to Victoria in eight days, twenty-one hours and thirty-eight minutes. The best previous record was established before the war by the sister ship, Empress of Russia, which made the passage in nine days and three hours.

MONTREAL NOTES

The Montreal offices of the Canuck Supply Company, formerly located at 416 St. James Street, have been removed to more commodious quarters at 371 Aqueduct Street.

* * *

W. J. Brown, manufacturers' agent, 117 Youville Square, Montreal, has taken the Eastern Canadian agency for R. S. Newall and Son, of Liverpool, England, manufacturers of wire rope since 1838.

* * *

The Swedish Steel and Importing Co. are moving their offices from 137 McGill Street to 170 McGill Street, where they have taken over the entire fourth floor of the building. They are contemplating extension to their present activities.

* * *

With the signing of the agreement between the Shipliners' Association and the various steamship firms in Montreal, any possibility of labor troubles on the Montreal water front this season was wiped out. The new contract entered into calls for a reduction in the wage scale of about 15 per cent. below that in force last year. The new rate of wages will be 60 cents an hour for all day work and 75 cents an hour for night work, with double time for Sundays. Like the practice followed in other shipping agreements, both parties to the contract were required to place a deposit of $500 with a trust company as a guarantee of the due performance of the agreement.

* * *

Work on the reconstruction of the old Fraser Building in Montreal has been started during the past week. When completed this will be occupied by the offices of the Furness, Withy Company. The building is one of five stories and the two lower ones will be reserved for the services of the Furness Company, while the other floors will be leased to other tenants. The building will also house the offices of the Quebec Steamship Company, which was purchased by the Furness, Withy Company last year. The new offices are expected to be ready for occupation this fall.

* * *

An event of unusual interest in the port of Montreal during the early part of the month was the arrival of the large American flying boat which was making an observation trip from New York to Detroit by way of Montreal, Toronto and Buffalo. It was not expected that the boat would remain long in Montreal, but on her arrival there it was discovered that one of the cylinders had been injured from the breaking of a piston ring. Before repairs could be effected it was necessary to send for new parts to New York, and the delay in getting the pieces meant a stop-over of two days. The repairs were carried out at the plant of the Canadian Vickers Co.

* * *

A new steamship company to be known as the Inter-Continental Transports, Limited, has been formed to operate a line of twelve ships between Montreal and British and European ports. The vessels to carry on the business of the company will be supplied jointly by the Canada Steamship Lines and the Bergen Agent A. S., of Bergen, Norway. It is the intention of the company to have all the vessels rechristened with names of Ontario counties. The two shipping firms mentioned above will be the representatives of the newly organized company at either end of the route. The Norwegian firm operates a large fleet of their own vessels in addition to being agents for many others, so that vessels will be available at any time and can be secured almost at any port by cable. This new service will provide for a sailing out of the port of Montreal once a week.

* * *

Active construction work at the shipbuilding yard of the Canadian Vickers Company at Montreal came to an end with the launching of the Norwegian cargo steamer "Topdalsfjord" which took place early this month. It is interesting to note that this last ceremony was witnessed by the members of the Federal Government in a body, they being here in connection with the official opening of the new harbor shed erected last year by the Harbor Commissioners. In speaking of the operation of the Canadian Vickers Company, A. R. Gilman, the managing director, stated that the company since 1918 had launched over 175,000 deadweight tons in cargo shipping, in addition to a large number of trawlers, submarines and other war vessels constructed previous to that time. It had been reported, he said, that the Vickers plant here would be closed down following the launching of this vessel, but while stating that it would be necessary to reduce the number of men working in normal times on new work, there would still be required a considerable number to do the work of repair that would be carried on during the summer months.

The Canadian Recruit Sustains a Break Down

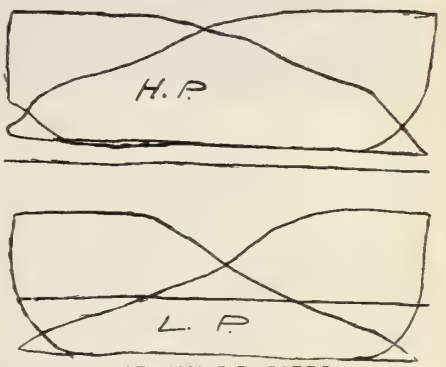
The Intermediate Cylinder Being Damaged Beyond Repair, the Engineers Effected Temporary Repairs Which Enabled the Ship to Complete Her Voyage, a Run of Over 4,000 Miles

By GEORGE C. STEPHENS

WHILE on a voyage from Halifax to Barbados, Trinidad and Demerara with part cargo to each of these ports, in the "Canadian Recruit," when 250 miles north of Barbadoes, the nut of the I.P. piston rod at the crosshead end came off, the piston came up and burst the cylinder cover and walls of the cylinder, which made that engine useless. I blocked the steam ports admitting steam to the cylinder, at the bottom port first with wooden wedges fitted about 15 inches up the cylinder with cement, fire clay and bricks. Blocked the top steam port with wooden wedges hard driven in, put the piston valve in and raised the top ring off the flange 1 inch to allow the steam from the H.P. to flow into the exhaust leading to the L.P. The steam is admitted into the I.P. outside and exhaust in the centre. Disconnected the connecting rod brasses from the crank shaft, also the eccentric straps to allow everything for the I.P. to be free; all of which was done in 12 hours.

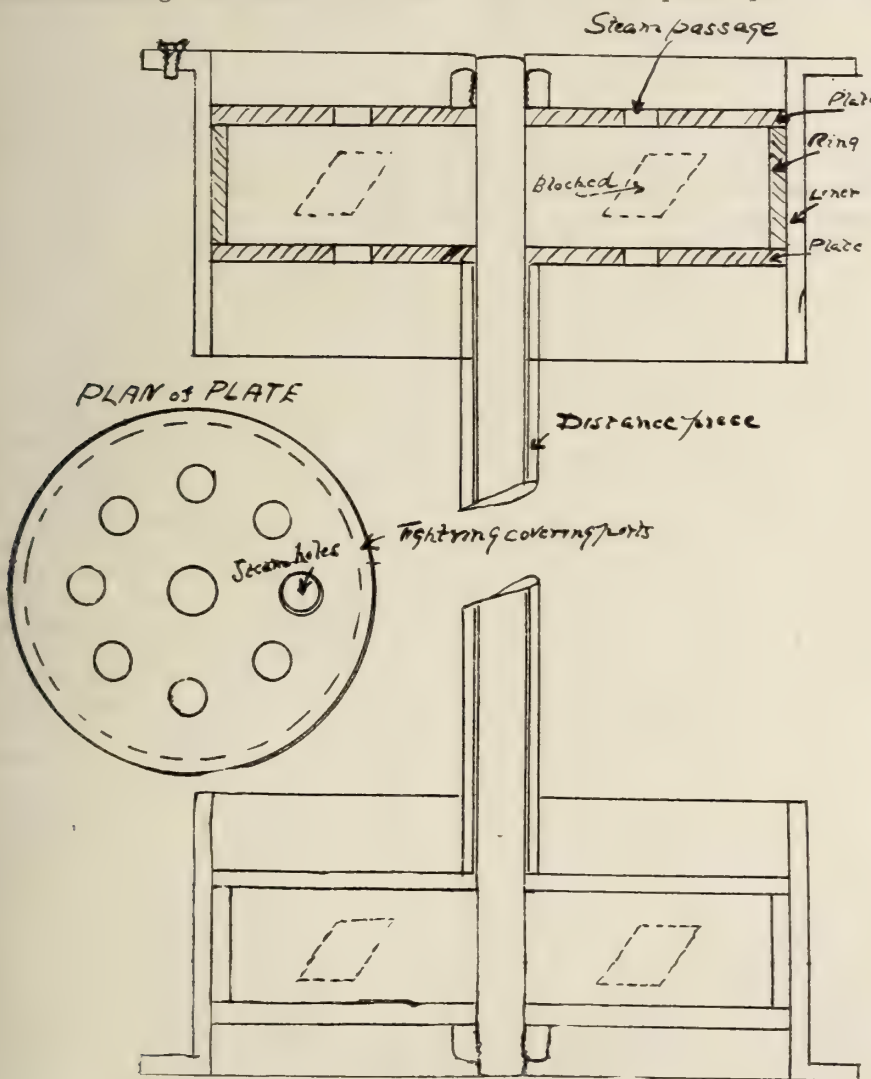
We proceeded to Barbados and got a seaworthy certificate from Lloyd's surveyor there, allowing us to proceed to Trinidad and Demerara with these repairs and then make a more permanent repair to take us to a loading port for homewards. In Demerara, fitted tight wooden pieces into the valve steam ports, top and bottom, turned two rings 3-4 inch thick very tight fit in the valve liners, closing steam port top and bottom, two plates at both sides of the rings —fine fit in the valve liners, a long rod up the centre and screwed at both ends, a pipe in the centre between top and bottom plates and then screwed the nuts hard up, which kept the rings and plates in the same place.

We carried 180 pounds pressure and I was getting too much pressure on the L.P.—of course I did not allow 180 pounds to enter into the H.P. I allowed about 130 pounds on the H.P.—that gave



H.P. AND L.P. CARDS.

with the L.P. expansion linked up 20 pounds on the L.P. The H.P. indicated 262 I.H.P. and the L.P. 350 I.H.P. Instead of shifting the eccentric of the L.P. pinned 1-8 inch piece of plate on top and bottom of slide valve, by doing this it allowed me to open more on the H.P., of course the pressure on the L.P. slide valve chest was more, but the power was the same, that increased the H.P. to 300 I.H.P. and the L.P. about 350 I.HP. made more revolutions and gained speed and higher power. We left Demerara for Barbados and there proceeded light ship to Nuevitas in Cuba, loaded a full cargo of sugar for Philadelphia, discharged there and came to Halifax light ship, where we are now waiting for the new cylinder, having travelled 4,400 miles, encountering all sorts of weather. I was going very near the same revolutions with the two engines as with the three; of course I could not open up as much as I could have done with the three but went safely along.



SHEWING METHOD OF BLOCKING PORTS.

W. J. Brown, manufacturers' agent, 117 Youville Square, Montreal, has secured the Eastern Canada agency for Payne and Griffiths, of Birmingham, England, manufacturers of steam and hydraulic fittings and motor car gages.

The Dominion Engineering Works at Rockfield, on the Island of Montreal, are extending their foundry activities to the supplying of grey iron castings of every description for the general requirements of industry. The modern facilities of the plant enable them to execute orders for unlimited sizes of castings, and the machine shop equipment is capable of taking care of any piece of work turned out of the foundry. A large boring mill now being installed will be the largest of its kind on this continent.

THE "CANADIAN COASTER" ON HER TRIALS.

"CANADIAN COASTER" RUNS TRIALS

The "Canadian Coaster," recently launched from the yard of the Collingwood Shipbuilding Co. at Kingston, underwent her trial trip in the Bay of Quinte early this month. The trials were highly successful, the average speed being 12.24 knots per hour. The following gentlemen were aboard during the trip: E. R. Venables, F. A. Willcher, representing the Department of Marine; D. McArthur, for the British Corporation; P. Thompson, Canadian steamship inspector; Mr. Day, Howden's Forced Draft System; and F. E. Courtice, chief engineers Collingwood Shipbuilding Co., Collingwood. Following the trials the vessel was handed over to the Government, and subsequently left for Montreal.

A NEW KIND OF SHALLOW-DRAFT VESSEL

Considerable interest is being shown in the skimming boat which Messrs. Yarrow & Co. are running on the Clyde, both river and firth, and which is propelled by an aeroplane type petrol engine and air propellers. The hull is of the hydroplane type which skims on the surface and is made in five sections of light but strong construction, the sections being joined together on the semi-rigid principle. On this model eight passengers can be carried and their exhilarating experience can be well imagined when it is known that this novel little craft can travel at the high speed of 50 miles an hour.

The problem of designing vessels for carrying passengers or cargo or for war purposes where the available depth of water is very limited has for many years been one of the most interesting studies. Not only must the shape of the hull be suitable to carry the load on the limited draught, but the mechanism employed for propelling the vessel must be limited to this same depth of water or preferably less. The type employing a paddle wheel, either at the sides or at the stern, was an early development, followed later by the Yarrow system of providing a screw propeller working in a tunnel sealed at the after end with the Yarrow patent automatic flap, an arrangement which enables a propeller to be efficiently employed in spite of its diameter being much greater than the depth of water. The selection of one or other of these types depends upon the conditions under which the vessel is to run.

The skimming boat with the air propeller referred to above is the latest type of shallow-draught vessel and has many advantages peculiar to itself. Messrs. Yarrow being interested in all types of shallow-draught vessels, and having long experience in this class of work, realize the possibilities of the skimming boat which takes no heed of weeds, nor whether the water to be travelled over is six feet deep or only six inches.

The development of this type of vessel is due largely to the Comte de Lambert, who was the pioneer of skimming boats. He started experiments in 1897 with steam-driven water-propeller vessels on the Thames and has been experimenting ever since. As one of the pioneers of flying in Europe, the Comte de Lambert, who worked in conjunction with the Wright brothers, was the first to fly round the Eiffel Tower, for which he was awarded the Legion of Honour. He is well known as a competitor in the early motor boat races at Monaco and elsewhere. It should be mentioned that Major J. P. Ashley Waller, Audrey House, Ely Place, London, is the selling and manufacturing agent in this country for the "De Lambert" skimming boats.

The great advantages of such a craft for carrying the officials of shipping companies from one place to another at a speed of up to 50 miles an hour are quite obvious. For carrying important mails it should also be of great service in many parts of the world. And again as a gun boat or police boat carrying a machine gun, the use of a vessel of this type, capable of being in one place at one moment, and a hundred miles distant two hours later, should appeal strongly to any Colonial Governments where natives are liable to give trouble.

The skimming boat is undoubtedly a valuable addition to the range of shallow-draught vessels.

MOTOR FIRE FLOAT

On a recent occasion the aptitude of British manufacturers for making motor lifeboats was referred to. This sort of aptitude is also displayed in the design and construction of motor boats for fire fighting, and one of this class has just been completed for Bristol where it replaces a steamboat which has been in service for thirty-four years. This vessel has been built by the well-known British firm of Merryweather & Sons, of Greenwich.

The advantage of having an internal combustion engine is that a great deal of power can be accommodated in a small space and, in the present case, the boat, which is only 51 feet in length, with a beam of 12 feet and a draught of 2 feet 9 inches, accommodates machinery of 130 h.p. This is used for propulsion and also for pumping plant, which is capable of delivering 1,000 gallons per minute. Such an accommodation would be quite impossible on a steamboat of anything like the same size. The present boat is being designed to pass under bridges, which are in some cases only 7 feet above water line, and this is also a case in which an internal combustion engine scores over steam plant. The fire float has sleeping accommodation for two men.

The engines comprise two four-cylinder sets, each developing 65 h.p. with duplicate ignition systems and electric starters. The petrol tanks are carried outside the engine room on each side, thus safeguarding against fire. The pumping plant consists of two Hatfield reciprocating pumps, each with a capacity of 500 gallons per minute, the two pumps thus being capable of propelling 1,000 gallons per minute. The makers of these pumps claim an efficiency of 90 per cent. on actual test. The pumps draw their supply from below the water line and deliver to a fitting on the deck to which flexible hose can be attached, allowing six jets to be thrown at the same time. Alternatively, the output of both pumps can be concentrated through a powerful single jet in any direction.

The new fire float made a good journey from London to Bristol under its own power by way of the Thames and Avon Canal, and throughout the journey overcame successfully the difficulties of frost and floods which were prevalent at the time. The contract speed is ten miles per hour, and this was exceeded on a three days' run by 10 per cent.

The use of fire floats as an addition to the usual fire engines on land is necessary for the purpose of fighting fires which arise in docks, quays, or ships in harbor. In many cases the fire occurs

on a ship which can only be reached from the water side, and unless some such means were at hand it would be necessary to detach the burning ship from its mooring and tow it into deeper water, leaving it to the efforts of its own crew to extinguish the flames. The presence of fire float of the type described above, in which the whole of the propelling machinery is available for pumping water, is a very powerful addition to the efforts of the crew of a burning boat, and wherever such floats have been used they have very fully proved their utility.

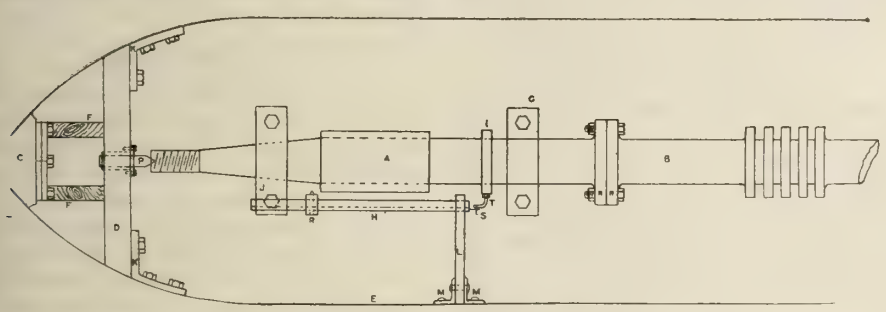
TURNING A PROPELLER SHAFT

A correspondent has sent us the following notes in connection with turning a propeller shaft, which he hopes will be interesting to readers.

Some time ago in Wellington, New Zealand, the Government had a sea-going training ship that was at one time a cruiser in the British Navy.

At the annual inspection, in dock, the bronze liner (A, shown in sketch) of the tail shaft for the propeller was found to be badly scored, and it was decided to turn it. This was no small order, as it would be necessary to remove a great part of the propelling machinery, or else cut away a part of the super-structure to remove the shaft, therefore it was decided to turn the shaft aboard.

The sketch gives some idea of the way this was done. Some time was required to get ready the tackle with which to do the job, in the meantime the intermediate shaft between the tail shaft A and the thrust bearing shaft B was disconnected and let down on the floor of the shaft



TURNING A PROPELLER SHAFT.

alley. The propeller was then removed from the end of the shaft A and the shaft was drawn inboard, through the stern gland C. The tail shaft, A, was then connected up to the thrust shaft B; a centre, P, was then made, and fixed to the channel iron D, which was bolted to the tunnel walls EE by the angle brackets KK, as shown, and backed up from the stern frame by two pieces of hard wood FF. The shaft was set to run true, and a steady bearing of hard wood was placed upon the pedestal sole plate, G, which had previously held the bearing for the intermediate shaft.

A heavy boring bar H (having a travelling tool collar, which is worked along by a screw embedded in the groove, as shown, the screw being operated by the star wheel S) was secured by brackets and clamp plates to the pedestal sole plate J, and the ship frame L. A collar, I, with a projecting stud T, was bolted to the shaft to engage the star wheel, S, of the boring bar. The tool was set to depth, and the main engines were started up, at a slow steady speed, and a very good job was the result.

The stern tube gland, C, was rebushed to suit the reduced diameter of the sleeve.

HALIFAX MOURNS LOSS

Although there are several of the steamers still in port waiting for orders, the winter season's operations at the port of Halifax of the Canadian Government Merchant Marine are concluded. Captain L. M. Hatfield, the marine superintendent here, with about all the staff of the various departments, has gone to Montreal to take up the work there for the summer season. A. Hector, the port agent, one stenographer, cashier and two clerks are the only members of the permanent staff remaining here to look after the business which happens along during the summer. One of the two clerks will be leaving for Montreal later.

The headquarters here looked like an abandoned cemetery yesterday, whereas up to last week the various departments showed a small army of stenographers and typewriters, clerks and department heads working at high tension to keep abreast of the volume of business pouring in. Everywhere about the rooms yesterday were unoccupied chairs and desks. It gave our representative, who was making his daily round of the south end terminals, an idea of what Halifax loses to Montreal in the summer season. The members of the staff who have gone may feel sure of a warm welcome when they return to the old garrison city next fall and so will the officers and men who operate the steamers so familiar to Halifax in the winter.

During the winter there were about ninety arrivals and sailings handled, representing one hundred thousand tons of cargo to and from all parts of the world. The crews of these ships have been paid off here and new crews signed on which means that there has been about three thousand men handled. It is to be noted that none of these ships have met with any serious mishaps or breakdowns at sea, although some have made several voyages across the Atlantic and during the very worst weather. It is also to be noted that the wages paid the men of the C. G. M. M. have been spent in Halifax as well as the wages paid the different shore staffs. Stores have been supplied by Halifax firms whenever they would do so as cheaply as others.

The cargoes have been carried and handled in competition with other shipping firms in the Canadian trade and it is interesting to note that the C. G. M. M., Ltd., can satisfy both the shippers and consignees in this, and therefore are getting a good share of the traffic moving.

In view of the above and knowing that this company is handling these ships as cheaply as possible and at less cost than even the English ships, it is difficult to understand why the shipping interests all over Canada should find fault with this company unless it is the progress the C. G. M. M. is making. By closely watching the company's operations and the personnel of same it is plain that they are out to do business in a business way and are prepared to carry on in competition with other large shipping firms and the general public need not have any fear as to their money invested in these ships as it appears there is none being wasted and the management is getting all that is possible to be had. It is unfortunate that there has been such a slump in the shipping business but this will not always be, and in the meantime the ships are being taken care of and will be in condition to carry cargoes for a good many years to come.

During a recent visit to Halifax of Mr. Teakle, the general manager of the C. G. M. M., that gentleman told the Herald that he was perfectly satisfied with the way things have been handled at Halifax this winter and also satisfied that all the officials here were doing their very best to secure a satisfactory result which undoubtedly has been obtained.—Halifax Herald.

At the last meeting of the Montreal section of the Engineering Institute of Canada, an address was given by G. E. Newill, the general manager of the Robb Engineering Works, of Amherst, N.S., on the development of turbine construction, and in particular, on the achievement of the Dominion Bridge Co., of Lachine, in building a turbine power installation for the British-American Nickel Co. at Sudbury. It will be interesting to know that this is the first time that an engineering firm in Canada has accepted the challenge to construct a large power turbine of this character, running as it did in about a quarter of a million dollars and requiring all the precision of mechanical discernment and nicety that might be needed in the making of a full jeweled watch to be propelled by steam.

Some Famous Ships of the Past

WHATEVER changes may be wrought in ships in the effort to mitigate increasing fuel and running expenses, it seems, to say the least, improbable that we shall come to another era of clipper sailing ships, and there is only too much reason to fear that Mr. John Masefield's line, "Earth will not see such ships as those again," will establish him as a true prophet. Having, then, little to contemplate in the present, and, apparently, less in the future, lovers of sailing ships must find solace in glancing back to the golden age when steam was in its infancy and oil engines were "undreamt, unthought of," and when one could take passage in a sailing ship with a reasonable possibility of completing the voyage in a length of time shorter than would be taken by a steamer.

Most fortunately, we have a historian to focus our backward glances. Mr. Basil Lubbock, whose "Round the Horn Before the Mast" may be fairly considered a classic of the sea, delighted us some time back with "The China Clippers" and now lays us still more deeply in his debt by giving us a volume on the Colonial clippers. Here is indeed a wealth of matter; pages crammed with the names and deeds of dead and gone shipowners, skippers and ships; happily not quite all dead and gone, for a few of the men still live, and—though for the most part with strange names, and no longer under the red ensign—a few of the ships still "tramp" the seas.

Steerage Horrors

Mr. Lubbock gives us the history of the Australasian clipper onwards from 1850, when the discovery of gold in Australia resulted in an extraordinary boom in emigrant traffic and led to the building of ship after ship whose name has become immortal in the history of our mercantile marine. Up to that time steerage conditions on board ship could well be described as revolting. Here is a picture which has come down to us from a report given before a Parliamentary committee:

The between decks were like a loathsome dungeon. When hatchways were opened, under which the people were stowed, the steam rose and the stench was like that from a pen of pigs. The few beds they had were in a dreadful state, for the straw, once wet with seawater, soon rotted, besides which they used the between decks for all sorts of filthy purposes. Whenever vessels put back from distress, all these miseries and sufferings were exhibited in the most aggravated form. In one case it appeared that, the vessel having experienced rough weather, the people were unable to go on deck and cook their provisions; the strongest maintained the upper hand over the weakest, and it was even said that there were women who died of starvation. At that time the passengers were expected to cook for themselves, and from their being unable to do this the greatest suffering arose.

The rush to the gold fields was to alter all this, although the first effect was to make it almost impossible to run ships of any kind, for the one desire of a crew entering an Australian port was to desert and make their way to the diggings. As we shall see later, a resolute master could find a way to overcome that difficulty. The demand for ships was insistent. London-owned Blackwall frigates were diverted from the Indian trade and American trans-atlantic clippers were hired or chartered in large numbers by Liverpool shipowners. But new construction alone could deal with the rush, and since trans-atlantic builders had a reputation for turning out speedy ships cheaply, orders from British firms began to pour into the shipyards of Maine and Nova Scotia, and the epoch of the Colonial clipper began. Up to then a 120-day passage to Australia had been considered good, and when Captain Godfrey of the Constance, using the Great Circle track, then newly advocated, made the voyage from Plymouth to Port Adelaide in 76 days it was regarded as a sensational performance.

Baines and the Black Ball Line

That was in 1850. How rapidly speed developed may be judged from the fact that five years later we find Messrs. Pilkington & Wilson, the founders of the White Star Line, making a contract with the Postmaster-General to land mails in Australia in 68 days or to forfeit £100 for every day in excess of that time. James Baines, the owner of the Black Ball Line, accepted a contract for a 65-day service on the same terms. This James Baines, a self-made man, became one of the shipping magnates of the day. His first ship was bought in 1851, and by 1860 the Black Ball Line had 86 ships and employed 300 officers and 3,000 seamen. But he took up auxiliary steam, overreached himself, and in 1889 died in poverty in a Liverpool lodging house. Before then, however, he had made much history. One of the earliest vessels of the Black Ball Line was the Marco Polo, which, besides marking a great advance in the way of passenger accommodation, was the first ship to cut down the voyage to Australia below the established 76 days. She left Liverpool on July 4, 1852, and arrived inside Port Phillip Heads 68 days later, having beaten the steamer Australia by a clear week. Her crew, following the custom of the day, would doubtless have deserted, but her master, Captain James Nicol Forbes, was not a man to be easily circumvented. He had promised to be back in Liverpool within six months of leaving that port, and on his arrival promptly had his crew clapped in jail and held till he was ready for sailing.

Some of the fast passages were made by the Sovereign of the Seas, which made the crossing from New York to Liverpool, dock to anchorage, in 13 days 22 hours, 50 minutes; the Lightning, which ran 436 nautical miles in 24 hours when crossing the Atlantic on her maiden voyage and 430 miles when running her east down in 1857; the Red Jacket, of the White Star Line, which crossed from Sandy Hook to Rock Light in 13 days 1 hour and on six successive days averaged 336 nautical miles a day; the Champion of the Seas, the James Baines and the Donald Mackay—all wonderful ships with fine performances to their credit. But their career of usefulness was short. The rush to the gold fields slackened and died away; the American-built softwood clippers, becoming water-soaked and strained, were soon past their best; and the development of the Australian wool trade quickly saw them replaced by smaller but more durable British-built hardwood clippers.

The Wool Trade

In the new trade stowage became a fine art, and we are told that Captain Woodget of the Cutty Sark—which turned to wool when the China tea trade passed to the steamers—was able to get into her 1,000 bales more than his predecessor. Speed, too, was as important as ever. The lists of the London wool sales were closed directly a sufficient number of cargoes had arrived or been reported in the Channel, and it was a custom of the trade that the fastest ship was loaded last. The Orient, White Star, and Aberdeen Lines all had a prominent part in the trade. Of the 1,000-ton clipper Orient, the pioneer ship of the Orient Line, a good tale is told.

In 1873, the Orient was just about to leave London for Adelaide, when old John Willis, with his frock-coat flying open and his white hat on the back of his head, came aboard and said to Captain Mitchell: "The carpenter of my Lammermuir has left his tool chest and tools behind; will you take them out to Adelaide and deliver them to him?"

"No," replied Captain Mitchell, who was a skipper of the good old sort, "but

I will take them and deliver them before I reach the line."

The Lammermuir had sailed some ten days before, on the 12th of September to be exact. Old John Willis immediately offered to bet Captain Mitchell £5 that he would not be as good as his word. The bet was accepted and the Orient sailed on the 28th September. In 5 deg. N. a ship was sighted ahead and overhauled. It turned out to be the Lammermuir. Signals were exchanged, and a boat put over with the chest on board and the Lammermuir's carpenter duly received his tools as Captain Mitchell had promised. The two ships then parted company and the Orient eventually arrived at Adelaide on the 16th December, 79 days out, the Lammermuir arriving six days later.

Another prominent firm of those days was A. L. Elder & Co. Of their Beltana it is related that she was rounding the Horn, homeward bound and reeling along before a heavy westerly gale under topgallant sails, when a vessel was sighted ahead, head-reaching under three close-reefed topsails, though bound the same way as the Beltana. Angel, to show his contempt of such caution, immediately bore down on the stranger, and, passing ahead of him, put his helm down and brought his yards on the backstays. As the Beltana came up to the wind, she lay right down until the amazed crew of the stranger could almost see her keel, and momentarily expected to see her capsize or her masts go overboard. But the little ship bore this harsh treatment in the bravest manner, and, though her rail was fathoms deep in the scud to leeward, never stranded a ropeyard. Having crossed the stranger's bows, Angel rounded to close under her stern, then squared his yards and raced ahead again. The manoeuvre of "sailing round a vessel" was not one that most men would care to attempt in Cape Horn weather. Indeed, hardly was the Beltana on her course again before Angel's trembling mate approached his captain with a request to be allowed to shorten sail, only to be met by the scornful order of: "Get the royals on her; and then, if you can't find anything else to set, go below and ask Mrs. Angel to lend you her petticoat."

Conrad and the Torrens

Elders also owned the Torrens, which, in addition to having some fine runs to her credit, has a literary interest in that she had Mr. Joseph Conrad as mate for a voyage in 1893. Among the passengers on that occasion were Mr. John Galsworthy and Mr. W. H. Jacques. Readers of Mr. Conrad will remember that in "A Personal Record," he has related how he asked Jacques to read the unfinished manuscript of "Almayer's Folly." "'I will read it to-morrow,' said Jacques, and then watching the roll of the ship for a propitious moment, he opened the door and was gone. In the moment of his exit I heard the sustained booming of the wind, the swish of the water on the decks of the Torrens, and the subdued, as if distant, roar of the rising sea. I noted the growing disquiet in the great restlessness of the ocean, and responded professionally to it with the though that at eight o'clock, in another half-hour or so at the furthest, the topgallant sails would have to come off the ship."

The manuscript was read and approved, and that act of encouragement was to be one of the last services rendered by Jacques to English literature, for he caught cold on the passage and died shortly after.

One might go on for columns quoting from Mr. Lubbock's book and amplifying it with other reminiscences which are called up. The record is a wonderfully complete one; in fact, the author must have been tolerably successful in his effort to avoid the criticism, "Heaps about other ships, but my old barkey was one of the fastest and best known of them all, and he dismisses her with a line or two." We should like to suggest, however, that when the next edition is produced it would add greatly to its value if an index to ships and owners could be given.

NICKELING ALUMINIUM

A process for nickeling aluminium is described in Annales de Chimie Analytique as follows: The aluminium is immersed for two minutes in a cold solution of ammonia and potassium cyanide. The metal is then well washed and brushed with milk of lime until the surface acquires an even, brilliant white tint. Then the washing and brushing are repeated with water, so as to get rid of all traces of lime, and the metal immersed in an acid bath of manganese, and iron chloride. The metallic coating of iron or manganese which serves as the "mordant," as it were, to fix the nickel to the aluminium, forms upon the aluminium. After two to three minutes' immersion in the acid bath, the metal is rinsed with water and put in the nickeling bath, which consists of nickel sulphate. The anodes are plates of laminated nickel. The electric pressure used should lie between 2.5 and 3 volts, otherwise a non-adherent deposit would be obtained. The current density should be from 1 to 1.5 ampères per square decimetre. The treatment for moderate-sized objects lasts one hour to one hour and a half, and is followed by washing in boiling water and drying by compressed air.

LOCATING A RAILWAY BY AEROPLANE

According to a news letter of the Air Service, United States Army, locating a railway by aeroplane has been carried out by the 3rd Aero Squadron, Camp Stotsenburg, Philippine Islands, and one long flight has enabled a railway engineer to determine which one of three general routes will be used for the new road. It is stated that many months and thousands of dollars have been saved in the work. Instead of three parties of locating engineers being sent out to make the survey, only one will now be necessary. The new line is projected by the Manila Railroad Co. as an extension of its line from Cabanatuan, through parts of the provinces of Nueve Ecija and Nueva Vizcaya to Bayombong. The first trip was made with the chief engineer of the railway, passing over Mount Arayet and then following the Pampanga River until the railroad line was picked up at Gapan. The river was followed from Cabanatuan on to Pantabangan and over Mount Pangloriahan, thence to Bayombong.

WIRELESS PLANT

Belgium contemplates construction of a new wireless plant which will be among the most powerful in the world and capable of communicating with North America during the whole of the twenty-four hours, with the Argentine republic during twelve hours, but only eight hours daily with the Congo, owing to the unfavorable atmospheric conditions which obtain in the equatorial regions. The estimated number of words to be transmitted per month, says Engineering, is 1,800,000, or a daily average of 60,000, divided as follows: 35,000 to the States, 10,000 to South America and 15,000 to the Congo. The station will have a capacity of 750 to 1,000 kilowatts.

A very successful working test was made last week of the two new 30,000,000 gallon electrical pumps recently installed at the low level pumping station of the Montreal water works. These pumps will be put into regular service immediately, and with the other electrical unit that has been in operation for the past two years, will deliver approximately 75,000,000 gallons daily. It may be necessary to use some of the steam units but the majority of the steam pumps will be held in reserve and used only in cases of emergency. Plans are now under way whereby the entire amount of water required for the uses of the city will be filtered. At present the filtration plant has a capacity of about 50,000,000 gallons per day, and when the new additions are installed, at a cost of about $2,000,000, it is expected that about 120,000,000 gallons will pass through the beds daily.

Roy M. Wolvin, president of the British Empire Steel Corporation, sailed for England on May 3. It has been stated that while he is in England he will be in almost continuous touch with English interests in order that a great many details relating to the corporation may be settled as speedily as possible.

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Lloyd's Register Returns

THE returns of shipbuilding which we publish for the quarter ending March 31st, require some explanation if they are not to be misleading. For instance, at first glance, the tonnage under construction would seem to be well up to former quarters, and that the shipbuilding industry was enjoying a period of unexampled prosperity. Such is unfortunately far from being the case.

A large amount of this tonnage represents ships on which for various reasons work has been suspended. These causes are the very much lower values of shipping, the low freight rates and high cost of construction and a very large number have had their completion delayed through the joiners' strike, which has now lasted some weeks. The total amount of work suspended is 850,000 tons roughly. Another factor is that instead of 20 per cent. of the work under construction being finished in the quarter, which was the normal pre-war quota, the 1920 returns show only 13 per cent. completed and this year only 8 per cent.

There is a very large falling off in the tonnage commenced and the tonnage in preparation but not commenced also shows a considerable drop. This is the state of affairs in the United Kingdom and it is sufficiently bad, but the future does not look any brighter. The action of the miners in trying to coerce the rest of the country will result in further losses to the shipping trade which will again react on shipbuilding. Shipbuilding in other countries is not suffering the handicap that British shipbuilding is in uncompleted work, but as is the case in Canada, there is no more work in sight after present contracts are worked off.

It requires a great deal of courage for anybody in the shipbuilding and shipowning trades to face the immediate future, but fortunately they seem to be trades which have the faculty of enticing men of courage and outlook. They are all busy looking for the silver lining.

A Lonely Death

TOWARDS the end of April, fishermen passing Lighthouse No. 10 in Lake Superior, did not see the light. This was on April 26, and the next night, the light not being in evidence, they investigated.

Entering the lighthouse, the reason for the absence of the light was discovered. The keeper lay dead on his cot. He died alone and unattended, with no chance of sending a warning or getting the help that might have saved his life or at least prolonged it.

That is one side of the picture. The other side is that a light placed for the express purpose of warning vessels from a dangerous rock and giving them a point to guide them into the safe channel was for a certain time as useless as if it did not exist. It may even be claimed that it was worse than useless, for a vessel shaping a course to pick up the light, might easily be on top of it before the danger was discovered. Luckily, no disaster of this kind happened.

The question is, should such a possibility be allowed to occur? Here we have a Government which lavishes money with an open hand on many purposes which could well be less heavily dowered and acts the part of a miser where life and property may easily be lost as a result. Of course, a lighthouse keeper has but little political influence and there are other places where the money talks louder than on a lonely rock in Lake Superior. The Government will probably say, "Oh, but look here, it's very seldom we have this sort of thing happen." Fortunately for the interests of those who navigate the lakes, this is true, but it makes the matter no better.

The wages of a lighthouse keeper are not on a very munificent scale. We imagine the value of one vessel and cargo would pay the wages of all the lightkeepers on the lakes for one season. How much would it cost the Government to have two men instead of one in every lighthouse on the lakes which is remote from the shore?

There have been many attempts to remedy this crying evil during the past. Nothing seems to be able to stir the department and make them realize the situation. We imagine that the only way would be to take the Minister of Marine away from his comfortable offices, friends and civilized comforts and leave him alone on Lighthouse No. 10 for just one month. He would have a real appreciation of the joys of a lighthouse keeper at the end of that month and might be moved to do something humane which might never bring him even an extra vote. On the other hand, he might, as most politicians do, forget all he intended to do as soon as he set foot ashore again.

The latter is the more likely.

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News of The Shipping World

THERE has been considerable interest aroused in the Old Country over the performance of some of the Yarrow type water tube boilers with which the navy was fitted. It may be remembered that many of the German vessels showed unaccountable bursts of speed when being pursued by British men-of-war, and in some cases worked up to several knots above their trial speeds. It now appears that the reason for this was that they had adopted circular wrapper plates for their Yarrow type boilers instead of the D-shaped type used by the British vessels, and thus were enabled to carry a great deal more than their rated pressure when an emergency arose. The British ships, many of which had the D-shaped wrapper plates, were restricted to their ordinary working pressures and in some cases less than this. The "Dartmouth" blew up in harbor when the pressure was considerably less than normal due to the failure of these D-shaped wrapper plates, and several accidents occurred on other vessels. One of the most curious was that of a boiler being tested hydraulically, the wrapper plate failing in such a manner that a sheet of water at very high pressure was ejected with such force that a man who was engaged in inspecting the tube ends for leaks was cut in two.

Most of these facts came out in the course of an investigation in which the firm of Cammell Lairds were claiming recognition from the Admiralty of improvements made to these wrapper plates on the Yarrow type of water tube boiler. The plates were made circular in form in order to be able to carry the high pressures required, and the tubes were entered into the tube plates at different angles in order to eliminate the necessity of curving the ends. It was in order to get away from this feature that the D-shaped plates were originally introduced.

* * *

The correspondent of Lloyd's List Weekly Summary at Dundee sends the following story of an adventurous voyage, which consumed 47 days instead of the six which is a normal time for the trip. Here is the story:

The Esthonian steamer Sakala, of 999 tons gross, which left Reval on Feb. 22 with a valuable cargo for the United Kingdom, has arrived at Dundee after a voyage of two months on what should have been a run of about six days.

In addition to 23 tons of flax, the Sakala carried a large consignment of gold, which was being sent by the Esthonian Government to the British Government. This was valued at 2,250,000 roubles (nominally £250,000 sterling), and weighed 2 1-2 tons. When she left Reval the vessel was accompanied by an icebreaker, but only thin ice was encountered, and when one day out the icebreaker returned as it was thought that the Sakala could easily work her own way to open water. After about five hours, however, owing to dense fog and heavy weather, the vessel ran into thick, drifting ice, and her progress was completely blocked. Ultimately she was frozen into the masses of ice, and was found to be drifting towards the north, where there were many unswept minefields. Realizing the danger, the Master (Captain Raas) had all possible pressure put on the engines, with the result that, after many hours of arduous work, the vessel forced her way into clear water.

Soon afterwards the machinery broke down. At that time the Sakala was only 30 miles from Reval, but it was impossible to return to that port. Ultimately the engines were repaired to such an extent that the vessel was able to make half speed and to reach the Kattegat. There she encountered a severe storm and had to anchor off the Danish coast for some time. In the Skagerack she ran into an even fiercer storm, in which hurricane winds came from the south and north-west alternately, and the seas swept over the decks and carried away everything movable. With engines of only half-power very little could be done, and the Master decided to ride out the storm as best he could.

The weather increased in severity and for five days the Sakala was tossed about the North Sea at the mercy of the winds and the waves. Food and water became scarce, and there was only coal for three days. Then, as a result of the heavy rolling of the vessel, the shafting connection bolts were lost, and the steamer became even more helpless. Although they were by that time about a hundred miles from the Norwegian coast, the Master decided to make for the nearest Norse port. In this plan he saw the only hope of saving the vessel and cargo, and the crew of 27 men and two stewardesses. At a very low speed, and still in heavy weather, the port of Arendal was reached.

There it was found that the necessary repairs would require some time, and it was decided to transfer the consignment of gold to a Wilson liner which was bound for the United Kingdom. This was done, and after 47 days undergoing repairs at Arendal, the Sakala resumed her voyage and reached Dundee safely.

* * *

Captain Evans, of H.M.S. Carlisle, on the China station, and late of the destroyer "Broke," which under his command achieved undying fame in the war, has again been covering himself and the service with glory. On this occasion it was rendering service to the stranded steamer "Hong Moh," which went ashore on Lamock Island while on a voyage from Singapore to Southern China ports, with a large complement of passengers. H. M. S. Carlisle and H. M. S. "Foxglove" on getting the news proceeded to the assistance of the stranded ship, and performed yeoman service. Captain Evans on two occasions dived overboard, on the first occasion getting a line to the wreck when no other means could do it, and thus saving over 100 lives. On the second occasion he went overboard to clear the propeller of one of the motor launches that was rendering aid. The services were performed with a very heavy sea running, and in spite of all the efforts that were made several hundreds of passengers lost their lives. It would seem that when the vessel struck there was a terrible panic, and a free fight between passengers and crew for possession of the boats was waged, with knives and axes as weapons. The saddest part of the whole thing is that practically every woman on board was drowned, there being only one survivor out of two hundred women.

* * *

Germany is getting busy on the project of putting her mercantile marine back where it was before the war. One of the ways that she is employing is to give the shipowners of the country practical help, which is shown by a subsidy of $250,000,000 to enable them to build and buy ships. There are at present eighteen different German steamship lines out of Germany. There is another feature that should have some effect in bringing back the shipyard workers to some realization of the state of affairs. German yards are full of foreign ships which are being overhauled and reconditioned because the rate of exchange and the high costs of labor in their own countries make it impossible for owners to get the work done at home. The German workman is not striking for shorter hours and more money. He is digging in along with the German manufacturerer and German merchant and the German public generally, to regain what they have lost by their attempt to conquer the world. German goods are being sent abroad, German shipyards are getting work that they

should never be able to get if the workmen in Great Britain were not so busy in cutting their own throats.

* * *

For a long time it was feared that the contract for repairing the famous "Brussels," Captain Fryatt's ship, would be given out to Dutch or Scandinavian contractors, owing to the state of the engineering trade in Great Britain. The contract has been secured by a firm of Leith engineers, Messrs. Henry Robb, Ltd. An interesting feature of the contract is that the contractors are to cut a piece of brass or copper from the ship and forward it to the Belgian government as a souvenir, with a certificate of its being a part of the original construction. The "Brussels" has been purchased from the British Government by the Dublin and Lancashire Steamship Company, and will be used in the Irish cattle trade after the reconditioning has been accomplished.

* * *

The "Journal of Commerce," the leading daily shipping newspaper of Great Britain, is not too enthusiastic over the development of the electric drive for ships. The faculty of the U.S. shipbuilders to give themselves credit for being away head of the rest of the world is amusingly commented on in the following item taken from the columns of the engineering supplement of the Journal:

One does not want to minimise the enterprise of the U.S. shipbuilders in fitting so many of their standardised ships with geared turbine engines, but at the same time it would perhaps have been better if it had been accompanied by fewer sarcastic comments on our conservatism in sticking to the triple-expansion engine for so many of our tramps. As a matter of fact the gearing gave trouble from the very beginning, and it will be remembered how practically the whole output of one of the biggest fabricating yards was tied up in the fitting-out basin because the designers of the gearing had not made allowance for the inevitable distortion of the ship when she was fully loaded. However, American ingenuity got over that difficulty, and they were all soon at sea, but the gearing continued to give trouble, and has done so to this day. Therefore hopes ran high that the experiment of fitting the turbo-electric drive into the Shipping Board steamer Eclipse would put an end to the whole difficulty, and glowing reports have been appearing in the American press concerning the success of her first voyage to India. The other side of the picture is that we are now informed from a very reliable source that throughout the voyage her mean speed was half-a-knot slower than it had previously been, and that she burned two tons more fuel per day. However, the installation gave practically no trouble, and it is quite fair to count it as being tolerably successful, even if it is not surprisingly economical. Meanwhile, it is suggested to convert no less than seventy of the fabricated steamers to Diesel power, but as the Americans have had practically no experience with this type of propulsion an experiment on this large scale would be exceedingly risky.

Supremacy of British Shipbuilding

IN a recent speech the British Shipping Controller spoke with reasoned confidence of the ability of the British shipbuilding industry to hold its own against all comers. Years and years of preparation and experience were necessary for a nation to build up a great shipbuilding industry, and Britain alone had passed through that essential period. He saw great advantages too, from the difficulties which surround all industrial enterprises at the present time. Improvements did not come when business was good and everything was booming; genius and ability came to the front in time of depression. Speaking of the future of the oil engine for marine purposes—a field in which British marine engineers are making rapid strides—he referred to a British ship of 12,000 tons which had been out to the Far East and back at a speed of 12 knots and a consumption of oil of only about 20 tons per day. A steamship would have required about 80 tons of coal per day.

Turning Old Oil Into New

Frederic A. Talbot

THE extraordinary demand for oil during the war brought prominently forward the question of recovering it from waste materials at small expense. Chambers's Journal tells of such a method recently discovered by which this can be effected without recourse to any chemical process.

"The process in question," says the writer, "compels attention because it completely dispenses with any necessity to resort to chemical processes, which at one time were considered the only feasible solution of the problem.

"The system may be most aptly described as the effective application of dry heat combined with centrifugal force. The necessary plant comprises a cylinder or drum, inside which is placed a perforated steel cage, which in turn receives a basket contrived from wire or perforated sheet-steel. This basket is removable, to facilitate charging and emptying. The cage in which it is placed is so mounted as to be free to revolve, the necessary rotary motion being imparted by a jet of steam playing upon the blades of a small turbine directly connected to the cage.

"The waste—oil-soaked cotton rags, cotton-waste, mechanics' gloves, or whatever it may be—is dumped into the basket, and the latter is then inserted in the cage. The drum is now closed and the steam turned on. The jet of steam playing upon the turbine-blades causes the latter to revolve, carrying the cage and its contents round with it, speed being increased until a peripheral velocity of approximately six thousand to seven thousand feet a minute is reached.

"After the steam has performed its initial function of driving the turbine, it is not permitted to escape, but rises through a central dome to pass into the heart of the contents of the cage within. It permeates the whole of the material, thus heating it up, and in so doing renders the oil more fluid. Passing through the material, the steam escapes through the perforations in the cage, and thence into the outer air. The oil and the grease thus liquified become separated from the solid material as represented by the rag or waste, and upon release, under the centrifugal action set up, are forced through the meshes of the basket and the perforations of the cage, to fall within the annular space between the cage and the outer drum. The oily ingredients, being of the same temperature as the steam, are rendered exceedingly fluid, with the result that they run readily. The oil, falling to the bottom of the drum beyond the zone of centrifugal action, is now permitted to escape from the separator into the settling-tanks. Here any solid impurities which may be present gravitate to the bottom in a sediment as the oil cools, to be subsequently drawn off. If desired, filtering of the oil may be carried out simultaneously, the hot oil being conducted from the separator to vessels provided for this purpose.

"It will be seen that the process is continuous, it only being necessary to stop the machine at times to withdraw the basket and empty the contents, from which nearly all the oil has been extracted, and to insert a fresh charge. The fact that the whole of the retrievable oil has been extracted from the contents of the basket is apparent from the cessation of the flow from the drain-pipe into the settling or purification tank. The actual time occupied in the separating process naturally varies according to the heaviness and the character of the oil or grease.

"The apparatus itself is noticeable from its compactness, simplicity of operation, the small space required to accommodate it, and its high efficiency.

"The material from which the oil has been extracted, upon removal from the basket, is submitted to a washing process which extracts all dirt and other foreign matter. Upon emergence from the washer the material is placed in a drying-cabinet. When withdrawn from the cabinet it is ready for use once more, being as clean as when first served out to the workmen."

The Ancient History of Ship Regulations

To All Those Who Follow the Sea the Load Line is an Important Affair—The History of Load Line Regulating From the Earliest Times to Plimsoll is Given Here

By SIR WESTCOTT S. ABELL, K.B.E.

THE development of civilization is the history not of individual enterprise, but of collective effort, and this is particularly true when the question of the laws upon which it is constructed is being considered. The formation of any code of law connotes collective intelligence and interdependence; the possession of an all-embracing and perfectly equitable scheme of laws would indicate a very advanced state of civilization.

Inversely, the existence of a law presupposes the need of such a law; laws against crime imply the co-existence of crime itself; laws regulating commerce denote the establishment of trading; and laws for the loading, equipment, and care of vessels are a direct indication of collective maritime ambitions and effort on the part of the country or state responsible.

It is a commonplace of modern discussion that civilization is dependent upon transportation; it is equally true that the growth of civilization has been due to man's commercial activities throughout the ages—the very existence of our country is mainly the result of the migrations of various peoples in the early history of the world. Evidence of maritime activities does not in itself constitute proof of the existence of a conscious sea-going community. Unless records of laws governing sea traffic can be produced, the evidence merely shows the existence of seafaring individuals. In other words, until a community has produced laws organizing its mercantile trade, safeguarding the interests of its shipping merchants, and endeavoring to minimise the dangers of the sea, it cannot be called a maritime power, even though a number of its individuals have engaged in sea trade.

It is highly probable that the Aegean civilization, which has but recently been brought to light, was the earliest maritime power, but it is a regrettable fact that writings, with the exception of engravings upon stone, are among the most perishable records from which history can be compiled; added to that, maritime law had to a large degree been based on established custom, and has been so widely known as to call for little comment by the writers of the day. It is, therefore, surprising that the record available is as large as it is.

These records predicate the enormous antiquity of sea travel. Neolithic settlements have recently been excavated in the island of Crete which are estimated to have been established by immigrant tribes from North Africa prior to the year 10,000 B.C., and obsidian chips of the same period have been discovered in the island, pointing to intercourse with Melos, the only source of obsidian in the Aegean. These excavations in Crete have established the fact of the presence in the Mediterranean of a seafaring colony which was probably anterior to the earliest known Egyptian history. It is not at all unlikely that the dark-skinned people of that colony had a vigorous sea trade as early as 4000 B.C., while it is known that there was considerable traffic between Crete and Egypt from the time of the twelfth Egyptian dynasty—say 2500 B.C. —certainly by about 2000 B.C. This Aegean or Minoan civilization built a very large city in Crete ,and continued to prosper for another 1000 years at least, until their capital was burned by Dorian invaders from the North, in 1400 B.C., and was finally destroyed in about 1000 B.C.

The centre of this civilization probably drifted eastwards to the island of Rhodes, but it is yet difficult to determine the part which Rhodes played in prehistoric days. As far as can be ascertained at present, this island came under Greek influence somewhere about 1000 B.C., and remained dependent until it became an oligarchical republic, whose independence was recognized by other countries somewhere about 350 B.C., the capital city, Rhodes, having been established some 50 years before that date. By the aid of successful political alliances it retained a separate existence until somewhere about the beginning of the Christian era, but was finally laid in ruins by an earthquake about 50 A.D.

Contemporary with the Minoan era, there was probably a rival phase of maritime activity, controlled by another race of people.

The record of Egyptian sea enterprise is certainly limited, and it is not unreasonable to infer that the greater part of the trade between Crete and Egypt was carried on in Cretan vessels. On the other hand, the rise of the Phoenician sea power, which began about 2500 B.C., and reached its maximum probably in 500 B.C., tended to bring the control of the Egyptian trade more into the hands of the eastern races of the Mediterranean. Carthage, the offshoot of Phoenicia, founded about 1000 B.C., further tended to increase the influence of the Semitic races.

It is rather curious that, as far as can be seen, all these three powers, Crete, Egypt and Phoenicia, reached their maxmum at the same time, say, 500 B.C.

The growth of Semitic sea-power was encouraged by the Greeks at the expense of the Aegean civilization, which was gradually absorbed and controlled.

The Roman Empire played a minor part as regards maritime activities, and only pursued these in so far as they advanced its military policy of conquest and subjection.

There appears to have been a lull in maritime activity in the Mediterranean from the beginning of the Christian era to about 500 A.D., but this interval was marked by the establishment of the Italian Republics of Venice, Genoa, and Sardinia. These three republics reached their maximum activity somewhere about 1000 A.D., and were the most potent influences in regard to sea-power of the Middle Ages, their influence extending certainly up to the year 1500. From that time forward, owing to the world discoveries of America and the doubling of the Cape of Good Hope, the aspects of maritime sea adventure were considerably altered.

It may, therefore, be said that there were at least three phases of activity before the Middle Ages of which there is likely to be some historical record; the first pertaining to the Ægean civilization; the second to the Semitic; and the third connected with the Italian Trading Republics. Of the second of these we have very little record, probably owing to the thorough manner in which both Tyre and Carthage were destroyed; while the burning of the wonderful library at Alexandria probably caused the loss of documents which would have been of infinite value to-day. There are, however, surviving documents which give the text of what is known as the Rhodian Sea Law, which probably contains in a condensed form the sea customs and traditions of the Ægean civilization. This law as it is now known was consolidated by order of the Eastern Roman Empire somewhere between the years 600 and 800 A.D. Previous to that time the Emperor Justinian, in the early part of the sixth century, instituted a compilation of various laws which are now known as the Justinian Code, and this practice was copied by succeeding emperors.

This Rhodian Sea Law is probably the earliest record of any statutes which in any way limit or qualify the design, equipment, maintenance, or loading of merchant vessels. It contains internal evidence of being an attempt to reduce to writing the laws then in force in the island of Rhodes, which laws were held in such general respect that it may fairly be argued that, although the record is so late, yet the laws themselves were handed down to the island of Rhodes from the Cretans. As evidence of this, it may

be mentioned that, replying to an appeal by Eudaemon of Nicomedia, the Emperor Marcus Aurelius said: 'I am sovereign of the world, but the Rhodian law is sovereign wherever it does not run contrary to our statute law."

These laws were mainly concerned with the trading duties of masters and crew, and the rights of merchants and passengers, and they contained regulations for charter parties, bills of lading, average, salvage, and demurrage. It is, however, rather in regard to regulations for the ship and its equipment that this present communication is concerned, and in this respect it is fairly obvious that some system of measurement was adopted. One of the regulations requires that the ship with all its tackle was to be valued at 50 gold pieces for every modius, and that where the ship was old the value was to be reduced to 30 gold pieces.

The modius* was originally a unit of capacity, which rather seems to be the intention of the law, but there appears to be some dispute between authorities as to whether it may not have been a unit of displacement. The opinion of the writer, however, is that it was probably used as a unit of capacity.

The shipowner and ship master were held responsible that the hull was in a proper seaworthy condition because there are several references to penalties to be incurred in case of damage to cargo arising from leakage. It is also evident that the question of fire was seriously regarded, since the passenger was not allowed to fry fish on board, nor was he allowed to split wood.

The laws in relation to the equipment of the vessel are rather more complete, and, in particular, merchants hiring ships were recommended to make precise inquiries before putting cargo on board, to ascertain whether the vessel had a strong sail-yard, skins, anchors, ropes of the first quality boats in perfect order, and suitable tillers; and, further, to investigate whether the ship's sides were staunch.

There were also regulations as to the accommodation to be provided for passengers, and the sleeping space for the ordinary passenger was to be three cubits by one cubit, say, 4 feet 6 inches by 1 foot 6 inches. The references to women and child passengers are rather obscure, for the former were to have only one cubit of space, and a boy half a cubit.

One provision required passengers to take water by measure, which would apparently indicate that there was some regulation for the storage of water on board, and that passengers were rationed.

Careful inquiry has been made to see whether any reference was made to a load-line, or to any provision as to stowage of cargo or overloading of the vessel, but so far the search has been fruitless. It is peculiar that the complete and definite Rhodian law should not deal with this vital question, and it is not improbable that the omission is due rather to lack of technical appreciation by the compiler than to the inadequacy of the laws themselves.

The laws of Venice are more detailed in many respects than those of the other Italian Republics; and while the date of the documents containing these statutes is generally fifteenth century, yet it is not at all unlikely that they were in operation by 1000 A.D. or even before. These laws contain the first record of any attempt at official measurement of the vessel, and there is little doubt that such measurement took place in the builder's yard, as there are various enactments which take account of variations in length and breadth. Although it would appear that a register was kept of such measurement, no such record in tabular form has yet been traced by the author.

The ship was measured for capacity, which was fixed in terms of milliaria. It would appear that the milliaria is the migliaio grosso which is the equivalent of 1,580 libbre sottile, but there was also at Venice a migliaio sottile which was equal to 1,000 libbre sottile. The word "migliaio" is an obsolete substantive meaning "thousand," "grosso" and "sottile" are the equivalents of "gross" and "net" respectively, and the word "libbre" means "pound weight." It would thus appear that there was some relation between gross ton and net ton, and that this relation, 1.58 to 1, was very similar to the connection between the present-day gross and net ton.

The loading of the ship was fixed by her capacity in milliaria, and a sliding scale was given to indicate the relation between capacity and deadweight; thus a vessel of 1,000 milliaria was allowed to carry a cargo of 1,050 cantaria. The scale was graduated for every ten milliaria down to a lower limit of 200 milliaria, a vessel of this capacity being allowed to load 110 cantaria.

It is, therefore, evident that as the size of the ship went up the weight of cargo accordingly increased. It is not possible to give exact values to those figures until the whole question of mediaeval weights and measures has been investigated, but it would appear that the cantaro might be taken as the equivalent of 150 libbre grosso, which was approximately equal to 71¼ kilogrammes.

The Venetian law contained provisions as to the number of sails which should be carried by ships of different sizes, and the number of anchors, cables, and masts were also made to depend on the measured capacity. Regulations were laid down for reserve gear and ropes, while the material for sails was specified, and there is also a regulation concerning the thickness and length of the hempen ropes. The ships were required to carry both a barcha and a gondola, the former probably being a longboat fitted with sails, while the latter was a small ship's boat. It would seem, as was required by the Rhodian law, that every vessel was required to have a longboat, which was towed behind the ship. The question of tonnage was also used as the basis on which to determine the number of crew to be carried, e.g., every ship of 200 milliaria was required to have 20 mariners, not counting soldiers, pilgrims, and cooks, and for every additional 10 milliaria above his number one extra mariner was to be borne. Plutarch, quoting from a more ancient author, states that five is the maximum number of men allowed per boat. Other writers, referring to a later period, speak of a general law applicable to all Greece, which fixed the maximum crew of its merchant ships at 100 men. This enactment was probably made, however, as a preventive against piracy.

It is rather, however, in regard to the provisions against overloading, and for the stowage of cargo, that the laws of the Italian Republic differ in a very marked degree and show an apparent substantial development from the regulations of the Rhodian Sea Law. This difference may have arisen from the more adventurous trading of the Italians, in which the coastline was not so closely followed.

A Decree of the Council of the Doge of Venice, some time subsequent to 1468, states that, "a deplorable practice has been common for some time among us: our ships carry on deck so large quantities of merchandise that it may be said they have two and even three upper decks. The result is great danger, not only to the sailors, but to the ship's cargoes, which, heaped up to an enormous height, often become greatly damaged. . . . . .It is ordered and proclaimed, by authority of the Council, that henceforth no commander of a vessel shall allow the loading of cotton or of any other merchandise whatever, from the bow to the stern; the whole space must be free, except as regards the usual things required by the sailors. If this law be broken, the commander of the vessel shall pay a fine of 200 ducats in each case, and shall not be allowed to exercise his functions until the fine has been discharged."

It will be observed that the Republics of Venice, Genoa, and Sardinia paid particular attention to the overloading and loading of the ship, and in particular the Venetian laws make a further distinction between ships under five years old, ships between 5 and 7 years old, and ships which exceeded the latter age. There are many provisions also for the regulation of deck cargoes, ballasting of the vessel, heavy cargoes, and for the adoption of some form of load-line. A load-line was marked on the vessel in accordance with the ship's capacity. At Venice this mark consisted of a cross painted or carved or formed with two plates of iron. The Genoese vessels had a triple mark of three small plates of iron fastened upon a particular line on each side of the hull, while in Sardinia the load-line was the

*The Italian modius was one-third of an amphora, which latter is roughly equivalent to six

centre of a painted ring. Officers were appointed to examine the vessel after she was loaded and before she left the port, in order to see that this mark was not more than a certain depth below the water-line; if the mark were judged to be too deep, the excess goods were taken out, and the owner fined, such fine being sometimes twice the freight of the cargo loaded in excess. It is also to be observed that limited exceptions as regards the position of the load-line obtained in regard to vessels which sailed in a particular locality, e.g., within the Gulf of Venice, while the position of the line was required to vary with the age of the vessel. This question of allowing the loadline to be submerged a certain depth below the water-line is somewhat obscure, but is the version given by Ashburner ("The Rhodian Sea Law"), who is one of the foremost authorities on the subject. Lindsay, in his history of merchant shipping, appears to suggest that it was forbidden to submerge this load-line, but the evidence on this point does not seem to be quite clear. It should also be mentioned that there was a responsible person in an independent position, known as the "Scribanus" (Supercargo), who at Venice was required to report to the public authority any case of overloading.

As regards the ballasting of the vessel, there was at Venice a committee, composed of the navigating officer and representatives of the owner and merchants, which was responsible for the proper ballasting of the ship, and after she was loaded no ballast was allowed to be taken out except when necessity arose for the lightening of the vessel. If the merchants so agreed, however, the ballasting of the vessel might be left to the navigating officer.

The stowage of cargo in the hold was required to be carried out by the stevedores in a manner which was calculated to preserve the safety of the ship. Various statutes were issued regulating the stowage of heavy or light goods. In vessels with only one deck, that deck was reserved for extremely light cargoes or packages, while only light loads could be placed between decks where there was more than one deck. There was a further regulation at Pisa by which only one-quarter of the cargo was allowed to be placed between decks.

It is also of interest to notice that special regulations were in force for different trades, e.g., for ships carrying wood, horses, provisions, or engaged in the pilgrim trade.

While these Italian Republics were at the maximum of their power and influence, there were found in Western Europe similar trading communities, of which by far the most important in the Middle Ages was the Hanseatic League, which sprang from an agreement entered into by the merchants of Hamburg and Lubeck about the year 1241, whereby a guard was established for the mutual protection of their merchant vessels, and which became within a hundred years the most important commercial association in Europe. It was connected with more than seventy cities and towns, and its agencies entirely monopolized the trade of Flanders, Norway, and Russia. Trading was only permitted with League merchants and by the use of League ships. Owing to its power and arrogance it became a menace even to countries. For nearly 200 years its merchants had their own houses in London, with a jury to try their causes and two English aldermen to act as the head of the community. The League reached its maximum power somewhere about 1500, and the colony in England was practically disenfranchised by Queen Elizabeth about 1578.

Contemporary with this development England, by reason of the marine activity due to the Crusades, had begun to lay the foundations of her maritime law. The first evidence of this is obtained from the Laws of Oleron, which derive their name from the island of Oleron in the Bay of Biscay; either they were drawn up by Queen Eleanor (the wife of King Henry II. of England) and afterwards enlarged by her son, Richard I., or, as some authorities think, the latter was entirely responsible for their authorship.

It would seem probable that this law was directly derived from the connection of Richard I. with the Italian Republics during the early part of the thirteenth century, for that monarch had an agreement with the Venetians for the fitting out of the fourth Crusade, whereby they supplied sufficient vessels to carry 4,500 knights, 20,000 foot soldiers, and nine months' provisions, together with a fighting escort of 50 galleys. There is also evidence that there was a close connection with France on the part of these republics, since Louis IX. contracted with the Venetians and the Genoese, in 1268, for the construction of some ships about 110 feet in length, with two decks.

There is very little reference in the Laws of Oleron to ship regulations, and the only extract so far discovered by the author reads as follows:

"It is ordained and established for a custom of the sea that if a merchant load wine in a ship, he may load the hull as full as the master reasonably could do with barrels without the master or anybody else putting anything on board or raising any hindrance."

It would appear that these laws were largely drawn up for the operation of the wine trade, in which the community of Oleron was principally engaged.

It is difficult to ascertain much about the regulations of the Hanseatic League. Codes dealing with various ports or sections of their activities have been examined, but the merchants carried on their activities in the greatest secrecy, and in their various settlements they lived personally in the strictest seclusion, like the inmates of a monastery. An interesting account of the Hanseatic settlement in England (the "Steelyard") is contained in Martin's "History of Lloyd's and Marine Insurance." It is not known, for example, to what extent, if any, the Mediterranean sea laws were either adapted or followed by the Hanse traders, or whether the laws were independently developed by that body. The only two references which are available, so far as ship regulations are concerned, are contained in the Wisby Town-Law on Shipping, which received its name from the town of Wisby, on the Baltic, and which probably dated from about 1288 A.D. The author has so far been unable to find any documents dealing with the regulations made at Lubeck by the deputies of the Hanse traders in 1597.

The Wisby Town Law certainly indicates the existence of a load-line, for it requires that if goods are loaded "above the load-line" the owner shall put these excess goods ashore, or shall pay a fine of 12 marks to the Senate. This comment is rather surprising, as it apparently indicates that overloading was permitted to those who could afford to pay for it.

It would also appear that some provision was made for the inspection of vessels; in fact, it is not at all unlikely that many of the vessels were owned under a system of co-partnership. The law states that "'should a sole owner employ and load his own ship it must be approved by the Senate, to see that it is both above board and below decks fit to go to sea, and that no goods are above the load-line." It might be argued that the Wisby load-line was an internal mark indicating the amount of hold space to be occupied by cargo, but not only had the practice of assigning an immersion mark already been adopted by the Italian Republics, but such a mark would perforce have to be altered for every class of cargo carried, since volume has no universal weight equivalent. Hence it is highly probable that the load-line was similar to those of other maritime communities.

There is an isolated reference to the record of a convention held by Frederick the Second of Denmark at Copenhagen, in 1651, which reads as follows: "and if he (the captain) overburthen the ship above the Birth-mark, he shall pay a fine." This appears to be contemporary evidence of the existence of a system of measurement and marking somewhat similar in purpose to that of the Italian Republics.

(Continued in next issue)

The National Shipbuilding Company at Goderich will rebuild factory at an estimated cost of $100,000. W. Hutchinson is manager.

* * *

S. S. Magoffin, contractor, will call tenders shortly for a warehouse in connection with the ocean dock his firm is now building at Vancouver.

MARINE NEWS FROM EVERY SOURCE

Sydney, N.S.—The first steamer to take a cargo of coal from Sydney to the United Kingdom since the strike of British miners was the "Maskinonge," which sailed on May 13. It is probable that this cargo will be the first of many.

* * *

North Bay.—One of the oldest captains on Lake Nipissing, Captain Callender, dropped dead on the street here recently. The deceased gentleman had been in conversation with a friend only a few moments before his death, and had remarked that he was feeling as well as he ever had during his life.

* * *

Victoria.—The Canadian cruiser Patriot grounded in Nanaimo recently and sustained damage that will necessitate her staying in dry dock for probably two weeks. The squadron which was going to leave Esquimalt for Halifax at the end of May will now have to delay their departure till the early part of June.

* * *

Montreal.—The first steamer to leave Montreal bound for Vancouver via the Panama Canal will be the Canadian Beaver, one of the C.G.M.M. vessels. She will be employed in the coasting service between Vancouver and San Francisco, and two other vessels of the Government Marine will be in the same service.

* * *

Prince Rupert.—The Canadian Government Merchant Marine steamer "Canadian Scottish," named after the famous regiment, was launched successfully at the Prince Rupert yard on May 12th. Mrs. C. W. Peck, wife of Col. C. W. Peck, V.C., performed the christening ceremony and the bottle of champagne used was hung about with the MacKenzie tartan, the colors of the regiment.

* * *

Toronto.—The gale that blew here on May 10, while probably not as severe as many that have visited the lake, yet caused sufficient disturbance to prevent the ferry steamers from crossing the bay, thus cancelling the baseball game on Hanlon's Point. It also prevented two freight steamers, the "Maple Grange" and the "City of Ottawa," from leaving their berth. The reason the ferry steamers could not sail was not on account of high seas, but the difficulty of handling these awkward craft at the landings. The smaller ferries carried on their usual sailings.

Halifax.—Commencing with July, there will be a new service between New York, Halifax and the Saguenay, under the auspices of the Furness Bermuda Line. The service will be inaugurated by the steamer "Fort St. George," a vessel of 14,000 tons displacement, leaving New York on July 2.

* * *

Sydney, N.S.—The steamer "Manchester Exchange," of the Manchester Liners, Ltd., at Sydney for bunker coal, reports the death of a fireman on the voyage through being buried in the coal. Being missed from his post he was found later in the cross bunker, where he had been last seen, suffocated in the coal. He was buried at sea.

* * *

Halifax.—Captain William E. Parsons, of St. John's, Newfoundland, died recently at that port. The deceased was well known in the Maritimes as well as Newfoundland, having for thirty years sailed on the coast. Twenty-one of these years were spent on the Labrador route, including Virginia Lake, Kyle, Sagona, Meigle and Invermore. He will be missed by the travelling public, with whom he was a favorite.

* * *

Sault Ste. Marie.—The captain and crew of the barge "Miztec," which broke from the steamer "Zillah" during a storm on Lake Superior, are believed to have been all drowned. The missing include Captain K. Pederson, Buffalo; Florence Pederson Cook; Mate, Robert Campbell, Tonawanda, N.Y.; Seaman Eroc Johnson, and Louis Florence, Hay City Mich.; Seaman John Drecker, Titusville, Pa., and another seaman unidentified who shipped from Port Huron, Mich. This is the first fatal disaster of the season.

* * *

Detroit.—The new law passed by the United States called "An Act to Provide for Treatment of Diseased Alien Seamen" makes the owners of vessels responsible for the hospital and medical expenses of seamen taken ill, or burial expenses for those who die while employed on their vessels. This applies only to those of other than United States citizenship, so that the owners are refusing to employ Canadian sailors on their vessels. In former years nearly every vessel had one or two Canadian sailors aboard, but under the new law owners will be careful to employ none but U. S. citizens.

Detroit.—The lake pilots and engineers on the railroad steamships have accepted a cut of 15 per cent. to take place immediately, and thus have averted a strike which would have tied up lake shipping. The lines affected are the Pere Marquette, Grand Trunk, Wabah Ann Arbor and the Mackinaw Transportation Co.

* * *

Vancouver.—The steamship "Bessie Dollar," of the Robert Dollar line, left this port recently with a cargo for New York, consisting entirely of British Columbia products. This included the largest cargo of shingles to leave Vancouver for a considerable time, namely 12,000,000. The rest of the cargo consisted of copper matte, canned salmon and lumber.

* * *

Halifax.—The hope of the Nova Scotia fishermen, the "Canadia" gave Halifax a rare treat when she sailed up the harbor on her voyage from Shelburne with a spanking breeze on her port quarter. She made the trip of 53 miles in four hours and thirty-five minutes, or a little better than 11 miles per hour (nautical). She was very effusively welcomed with sirens and whistles both afloat and ashore.

* * *

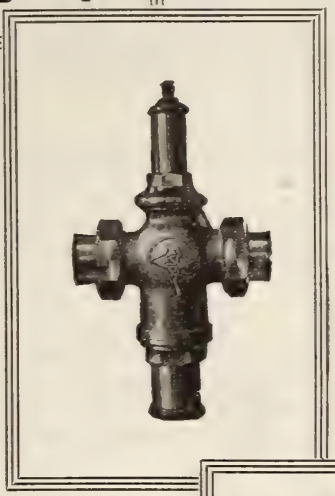
Montreal.—The first weeks of the shipping season have resulted in a greater rush on the grain elevators of this port. The Canada Steamship Lines have brought down over 3,000,000 bushels of grain from Port Colborne, and other carriers have brought down about half that quantity. There are a number of boats waiting their turn to discharge, while several ocean steamers are loading but the arrivals are far more numerous than the departures so far.

* * *

Cleveland.—The executive committee of the Lake Carriers' Association, at their recent meeting, decided to recommend a cut of 15 per cent. in the wages of all licensed officers. In order to give employment to as many officers as possible in view of the large numbers of vessels out of operation, many officers are to be assigned to a lower position than that they were holding last year. They will be guaranteed that their wages shall not be lesss than 50 per cent. of those paid for the 1920 season for the position that they were originally assigned to.

MASON

Mason Standard Bronze Redu ing Valve



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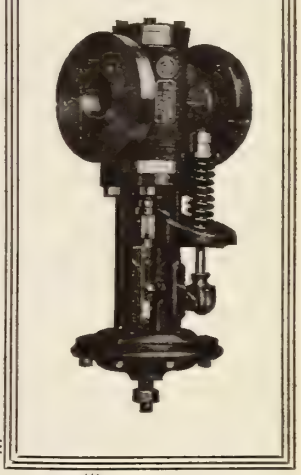
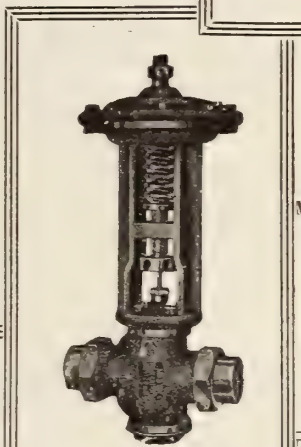
And we are not alone in this assertion. Engineers everywhere are strong in their praise of Mason performance. Performance that is a high attribute to the durability and accuracy of Mason construction.

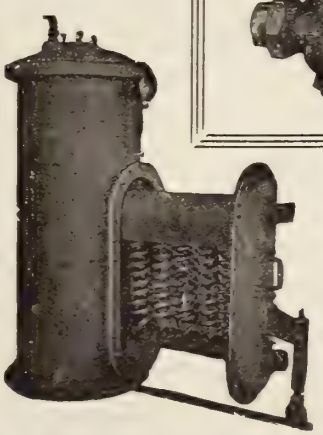
If you are not using Mason Appliances our catalogue will be invaluable. It is sent free on request.



Mason No. 126 Style Marine Reducing Valve.



Mason No. 55 Style Pump Pressure Regulator



Reilly Marine Evaporator Submerged Type.

The Mason Regulator & Engineering Co., Limited

MONTREAL and TORONTO

Sault Ste. Marie.—The barge Miztec, which broke adrift from the steamer that was towing her up Lake Superior recently, and was lost with all hands, has now been located, lying in 36 feet of water, five miles off shore. There was no sign of any of the bodies of the crew, but search is being continued in the hope of finding them. It is possible that some of them may be in the cabin of the barge.

* * *

Robert J. Balck died at his home in St. Catharines. For the last 25 years he, with his sons, had carried on the machine and repair business of the R. J. Black Machine Co. Previous to going into business he was a marine engineer for some 20 years. The late Mr. Black served his time with the C. Yale firm, builders of marine engines. He was well known in the St. Catharines district, and highly respected. His sons, Norman and William, are now carrying on the business.

* * *

Toronto. — The Canadian Pathfinder was launched from the yards of the late Dominion Shipbuilding Company, and will be completed about the middle of June. The Canadian Pathfinder is one of the Canadian Government Merchant Marine programme, and is one of the two ships being finished by the Collingwood Shipbuilding Co. since the Dominion Shipbuilding Co. went into liquidation. The engines and boilers are being furnished by the John Inglis Co., of Toronto.

* * *

Vancouver.—Mr. J. J. Coughlin, of the firm of J. J. Coughlin & Sons, speaking on his return from Ottawa, where he had been to interview the Minister of Marine, said that he had great hopes that when the present depression had passed there would be a boom in shipbuilding, probably two or three years from now. He said arrangements for the right of way through the dry-dock property for the terminal railways of the Harbor Board would soon be completed and that work would soon be started on the new plant.

* * *

Vancouver.—The month of May is going to be an active one for the local office of the C.G.M.M. The "Canadian Winner" will discharge a part cargo of wool, and load lumber for Australia, and the "Canadian Skirmisher" will also load for the Antipodes. The "Canadian Highlander" will load for the East Indies and China, the "Canadian Inventor" will arrive and discharge a cargo from India, and the "Canadian Importer" is homeward bound from Australia. One or both of these latter vessels will load outward for South Africa. The "Canadian Carrier" and the "Canadian Voyager" will load for Montreal via the Panama Canal.

* * *

Montreal.—The party of members and senators of the Dominion Parliament were conducted round the harbor of Montreal during the month, and were entertained on board the C.P.O.S. liner "Minnedosa." They were given a view of the launching of the Norwegian steamer "Topdalsfjord," from the deck of Canada Steamship Line vessel "Quebec," and later witnessed the opening of the three new freight sheds, which are among the largest in the world. They were informed during luncheon that the harbor of Montreal did a business of $700,000,000 and handled more than 15,000,000 tons of exports and imports last season.

NOTICE TO MARINERS

No. 8 of 1921

(Atlantic No. 5)

All bearings, unless otherwise noted, are true and are given from seaward in degrees from 0° (North) to 360°, measured clockwise, followed by the magnetic bearing in degrees in brackets: miles are nautical miles, heights are above high water of ordinary spring tides, and all depths are at low water of ordinary spring tides.

NOVA SCOTIA

(21) South Coast—Jordan—Light to be Discontinued

Position.—On breakwater, east side of Jordan River. Latitude N. 43° 45′ 30″. Longitude W. 65° 13′ 5″.

Light to be discontinued.—The fixed red light will be discontinued on or about 31st March, 1921.

N. to M. No. 8 (21) 1-3-21.

Authority.—Departmental Records.

Admiralty Charts.—Nos. 340, 352, 730, 1651 and 2670.

Publication.—Nova Scotia Pilot, 1911, page 203.

Canadian List of Lights and Fog Signals, 1920.—No. 259.

Departmental File.—No. 20259K.

NOVA SCOTIA

(22) Cape Breton Island—Sydney Harbor—New Edition of Chart

A new edition of the chart of Sydney harbor, numbered 415 of the Canadian Hydrographic Survey, corrected to January, 1921, has just been published.

Copies may be obtained from the Hydrographic Survey, Department of the Naval Service, Ottawa, for fifteen cents per copy, payable in advance.

N. to M. No. 8 (22) 1-3-21.

Departmental File.—No. 28499.

NOVA SCOTIA

(23) North Coast—Pictou River—East River—Trenton—Color of Range Lights to be Changed

Former Notice.—No. 75 (182) of 1920.

Date.—Opening of navigation, 1921.

Position of front light.—Near outer end of east pier at entrance to Stonehouse point lock.

Latitude N. 45° 37′ 42″. Longitude W. 62° 38′ 46″.

Change in color of lights.—The occulting white lights will be replaced by occulting red lights.

N. to M. No. 8 (23) 1-3-21.

Authority.—Departmental records.

Admiralty Charts.—Nos. 1889, 2034 and 1651.

Publication.—St. Lawrence Pilot, Vol. 2, 1916, page 203.

Canadian List of Lights and Fog Signals, 1920.—Nos. 571.5 and 571.6.

Departmental File—No. 20571.2C.

A. JOHNSTON,
Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 1st March, 1921.

* * *

No. 9 of 1921

(Inland No. 2)

All bearings, unless otherwise noted, are true and are given from seaward in degrees from 0° (North) to 360°, measured clockwise, followed by the magnetic bearing in degrees in brackets; miles are nautical miles, heights are above high water, and all depths are at mean low water.

QUEBEC

(24) River St. Lawrence—Lake St. Francis—St. Anicet—Character of Light to be Changed—Fog Horn to be Discontinued

Date.—On or about 1st May, 1921.

Position.—On bar, on south side of channel. Latitude N. 45° 9′ 25″. Longitude W. 74° 21′ 56″.

Change in light.—The fixed white light will be replaced by an occulting white acetylene gas light.

Remarks.—The light will be unwatched and the fog horn discontinued.

Authority.—Departmental records.

Canadian Naval Charts.—Nos. 52 and 51.

Publication.—St. Lawrence Pilot, above Quebec, 1920, page 138.

Canadian List of Lights and Fog Signals, 1920.—No. 1620.

Departmental File.—No. 21620A and K.

ONTARIO

(25) St. Mary River — Rains Wharf Range Lights—Front Light to be Moved

Date.—On or about 14th May, 1921.

New position.—Eastward of present position and about 436 feet 314° 16′ (N. 40° 44′ W. mag.) from back light. Latitude N. 46° 15′ 00″. Longitude W. 84° 5′ 20″.

Remarks.—The new bearing of this range will be in the same alignment as the new bearing of the Point of Woods (United States) range.

Variations in 1921.—5° W.

Authority.—Departmental records.

Publication.—Sailing Directions for Canadian Shores of Lake Huron, 1919, page 348.

Canadian List of Lights and Fog Signals, 1920.—No. 2118.

QUEBEC

(32) Richelieu River—Chambly Basin—New Front Range Light to be Established

Date.—Opening of navigation, 1921.

Position.—On site of former light, at southwest end of Chambly basin. Lati- N. 45° 27′ 23″. Longitude W. 73° 17′ 27″.

Character of light.—Fixed red catoptric light shown from a headlight lantern.

Description.—Mast, small white shed at base.

N. to M. No. 11 (32) 18-3-21.

Authority.—Departmental records.

Admiralty Charts.—Nos. 2830b.

Publication. — St. Lawrence Pilot, above Quebec, 1920, page 81.

Canadian List of Lights and Fog Signals, 1920.—No. 1368.

Departmental File.—No. 21368R.

A. JOHNSTON,
Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 18th March, 1921.

Pilots, masters or others interested are earnestly requested to send information of dangers, changes in aids to navigation, notice of new shoals or channels, errors in publications, or any other facts affecting the navigation of Canadian waters to the Chief Engineer, Department of Marine and Fisheries, Ottawa, Canada. Such communications can be mailed free of Canadian postage.

QUEBEC

(31) St. Lawrence River—Ship Channel Between Quebec and Montreal—Calvaire—Change in Position of Front Range Light

New position of light. — Above Cap Charles, 188 feet back from former site on line of range. Latitude N. 46° 33′ 23″. Longitude W. 72° 4′ 59″.

Elevation.—135 feet.

N. to M. No. 11 (31) 18-3-21.

Authority.—Departmental records.

Canadian Naval Charts.—Nos. 15 and 24.

Publication. — St. Lawrence Pilot, above Quebec, 1920, page 41.

Canadian List of Lights and Fog Signals, 1920.—No. 1279.

Departmental File.—No. 21279R and L.

UNITED STATES OF AMERICA

(26) St. Mary River — West Neebish Channel—East Side Upper Light No. 6 Re-established

Former notice.—No. 36 (86) of 1920.

Position.—In 3 feet of water, off Moon Island. Latitude N. 46° 13′ 10″. Longitude W. 84° 10′ 00″.

Light re-established.—This light has been re-established and the gas buoy discontinued.

N. to M. No. 9 (26) 8-3-21.

Authority.—U. S. Department of Commerce N. to M. No. 5 of 1921.

ON ADMIRALTY AND INDIA OFFICE LISTS

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INTRODUCED 1854—
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Agents and Stocks at 75-80 Ports.

Publication.—U. S. Lake Survey Bulletin No. 29, page 115.

A. JOHNSTON,
Deputy Minister.

Department of Marine and Fisheries,
Ottawa, Canada, 8th March, 1921.

* * *

No. 11 of 1921

(Atlantic No. 7)

All bearings, unless otherwise noted, are true and are given from seaward in degrees from 0° (North) to 360°, measured clockwise, followed by the magnetic bearing in degrees in brackets; miles are nautical miles, heights are above high water of ordinary spring tides, and all depths are at low water of ordinary spring tides.

PRINCE EDWARD ISLAND

(29) North Coast — Malpeque Bay — Darnley Basin—Range Lights to be Changed in Position

Date.—Without further notice.

New position of front light.—On west side of basin, ½ mile 293° 45′ (N. 42° 30′ W. mag.) from present position. Latitude N. 46° 33′ 20″. Longitude W. 63° 41′ 40″.

New position of back light.—650 feet 201° 45′ (S. 45° 30′ W. Mag.) from front light.

N. to M. No. 11 (29) 18-3-21.

Variations in 1921.—23° 45′ W.

Authority.—Departmental records.

Admiralty Charts. — Nos. 1983 and 2034.

Publication.—St. Lawrence Pilot, Vol. 2, 1916, page 186.

Canadian List of Lights and Fog Signals, 1920.—Nos. 787 and 788.

Departmental File.—No. 20787-8R.

QUEBEC

(30) Saguenay River — Pointe Noire — Change in Character of Front Range Light

Date.—On or about 1st June, 1921.

Position.—On the point, near its east extremity. Latitude N. 48° 7′ 19″. Longitude W. 69° 42′ 55″.

Change in light. — The fixed white catoptric light will be replaced by a fixed white dioptric light shown from a 4th order lens.

Remarks.—Light will be visible from all points of approach by water.

N. to M. No. 11 (30) 18-3-21.

Authority.—Departmental records.

Canadian Naval Charts.—Nos. 203 and 204.

Admiralty Charts. — Nos. 1370 and 2516.

Publication.—St. Lawrence Pilot, below Quebec, 1916, page 45.

Canadian List of Lights and Fog Signals, 1920.—No. 1112.

Departmental File.—No. 21112A.

WAGE REDUCTION

Effective the first of May a reduction of from 10 to 12 per cent. has been made in the wages of the employees of the Montreal Harbor Commissioners. In view of the scarcity of freight and the general depression of business the authorities of the port considered it not only advisable but essential that operating expenses be reduced in order to assure sufficient business to and from the port to maintain operations at a normal standard. In making the announcement, M. P. Fennell, secretary-treasurer of the Harbor Commissioners, stated: "Conditions today are not as they were during the war. In war time there was plenty of freight. Today freights are decidedly scarce, and it is necessary for the authorities of all ports to do everything in their power to attract business. It is up to the port of Montreal to assist shippers in every way possible, and to do this, operating costs must come down."

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Marine Engineer, Staines, England

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IN THE EXCHEQUER COURT OF CANADA
Toronto Admiralty District

Between:—

IMPERIAL TRUST COMPANY OF CANADA, Plaintiff

and

THE SHIP "Le QUESNOY"
THE NOVA SCOTIA TRANSPORTATION Company, Limited, Defendant

JUDICIAL SALE OF THE SHIP "Le QUESNOY"

Pursuant to a Commission of Appraisement and Sale, issued out of the above named Court, there will be offered for sale by public auction, with the approbation of the Local Judge in Admiralty, and subject to the provisions of Statutes of Canada, 9-10 George V., Chapter 42, by C. M. HENDERSON & CO., Auctioneers, at their Auction Rooms, 128 King Street East, in the City of Toronto, at the hour of half-past ten o'clock in the forenoon on Saturday, the Twenty-first day of May, 1921, the steel freight Steamship known as "Le Quesnoy."

The ship "Le Quesnoy" is an ocean-going vessel built in the year 1919, and her dimensions, tonnage, etc., are as follows:—

Type—Fredericksdtadt, Canal size, single deck steel bulk Freighter.
Class—Lloyd's plus 100 A1 for Ocean service.
Principal dimensions—Length over all .....261'
" B. P. .....251'
Moulded Breadth ..... 43' 6"
" Depth ..... 28' 2"
Draft Loaded—24' 1 1-8".
Registered Port of Toronto, February 7th, 1919.
Official No. 137910.
Gross Registered Tonnage 2715.65.
Net Registered Tonnage 1653.09.
Deadweight carrying capacity, including bunkers approximately 4298 gross tons.
Her engines and boilers were built in the year 1918 and are described as follows:
Engines—Inverted, triple expension, surface condensing, I.H.P. 1400—diameter of cylinders 20 x 33½ x 55" x 40" stroke.
Boilers—2 Scotch marine 14' x 12"—Natural draft 180 lbs. working pressure.

The Ship, with her tackle, apparel, furniture and appurtenances, will be offered for sale, subject to the right or rights of any existing engagements of Charter, and subject to a reserve bid, fixed by the Local Judge in Admiralty.

The purchaser shall pay down to the Marshal of this Court one-quarter part of the purchase money at the time of the sale, and the remainder thereof, without interest, within fourteen days after the date of sale.

The buyer is to take the said vessel, her tackle, apparel, furniture and appurtenances, with all faults, in the condition in which they then lie, without any allowance or abatement for weights, lengths, qualities, quantities, errors of description or any defects or injuries whatsoever, and neither the age, tonnage, nor description of the vessel, her tackle, apparel, furniture and appurtenances, stores or equipment are warranted.

Further particulars and conditions of sale may be had from MESSRS. McMASTER, MONTGOMERY, FLEURY & COMPANY, Solicitors for the Vendor, Temple Building, Toronto.

R. S. STONEHOUSE,
Marshal.

Dated at Toronto, this 3rd day of May, 1921.

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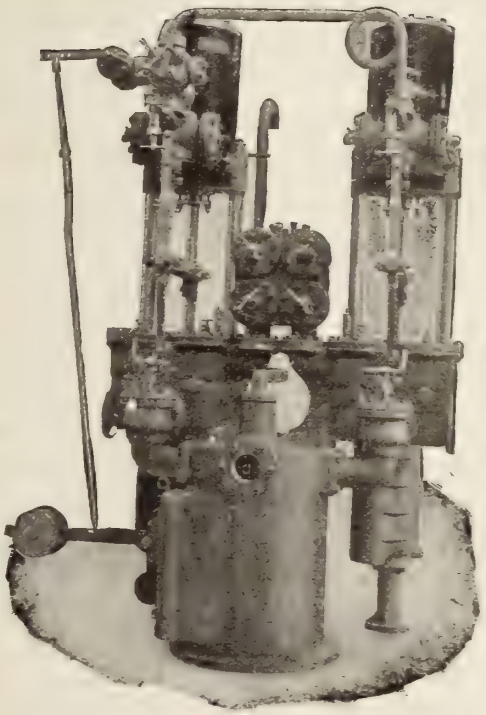

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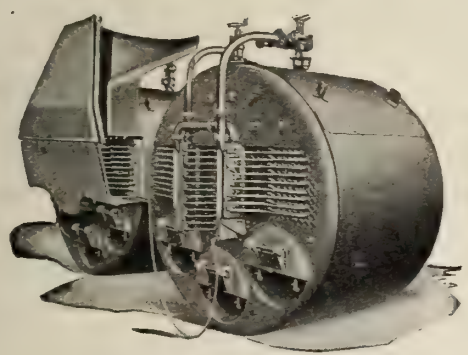

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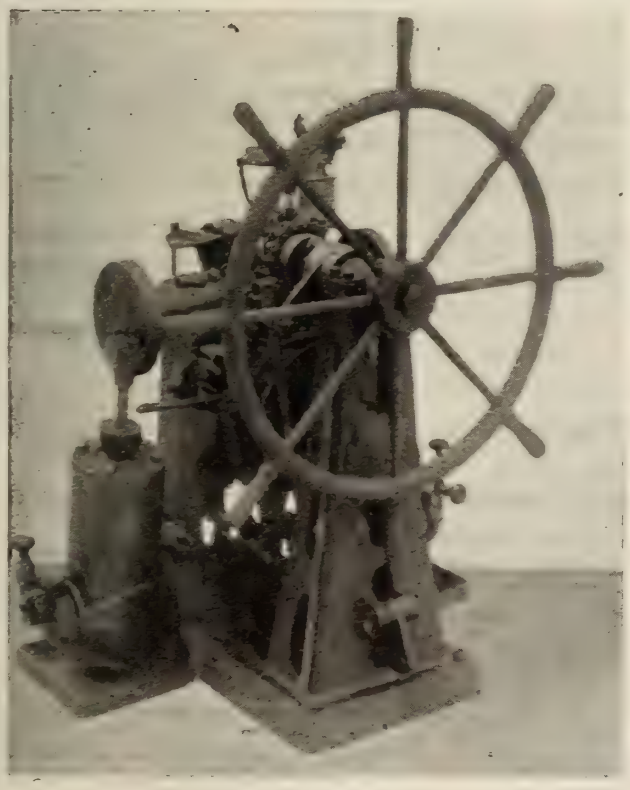

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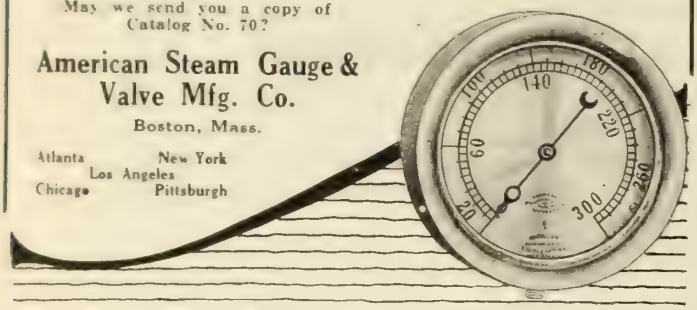

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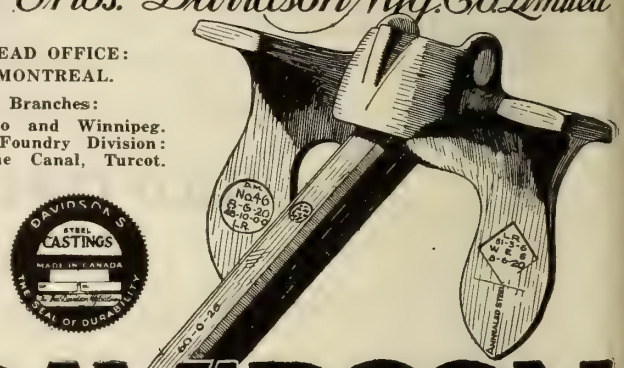

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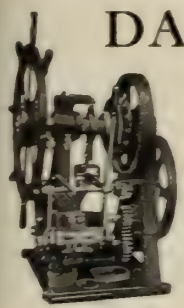

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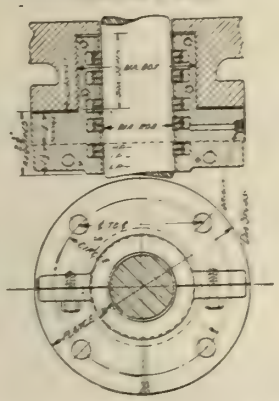

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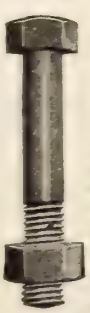

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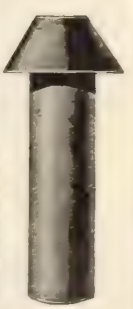

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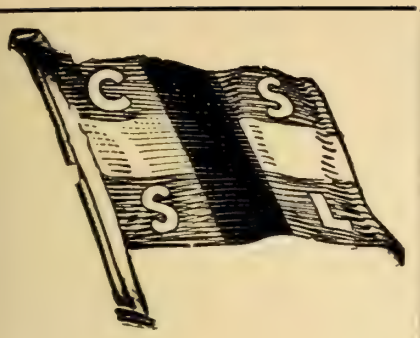

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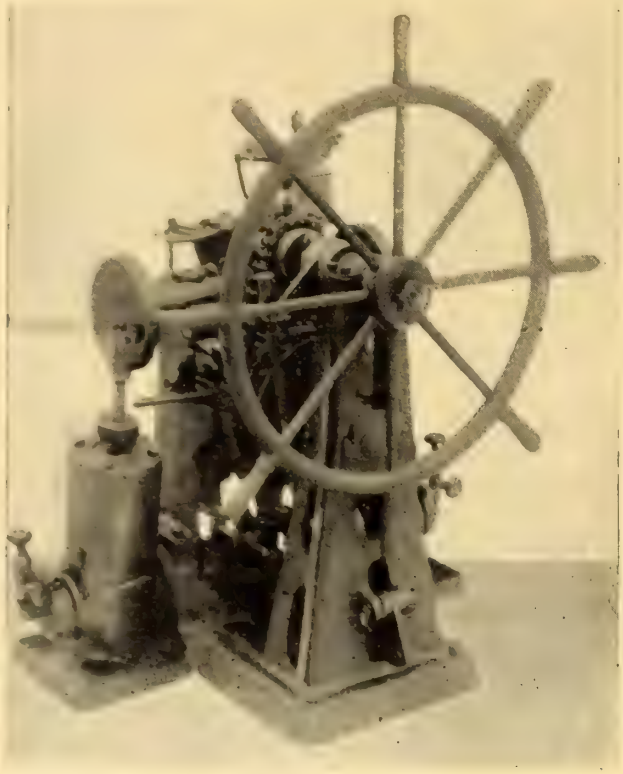

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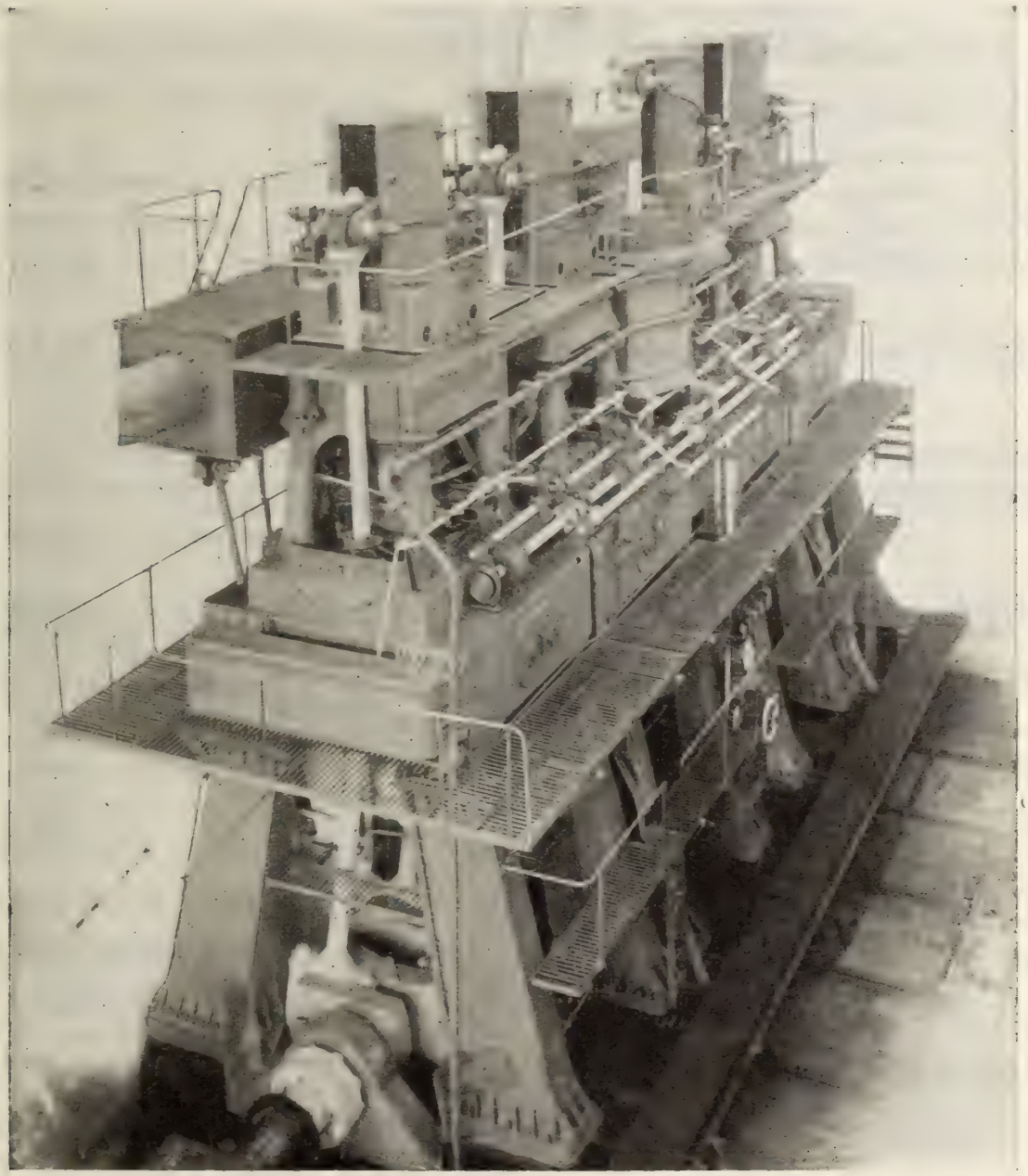

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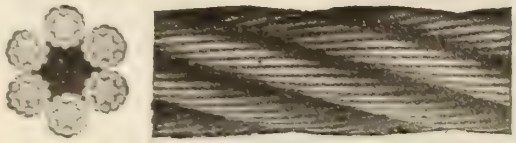

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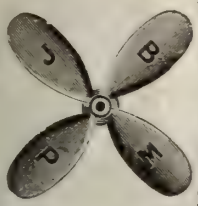

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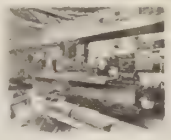

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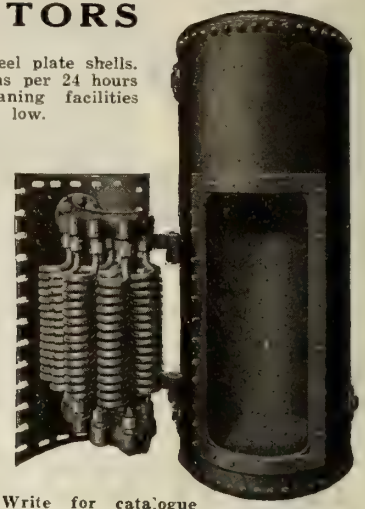

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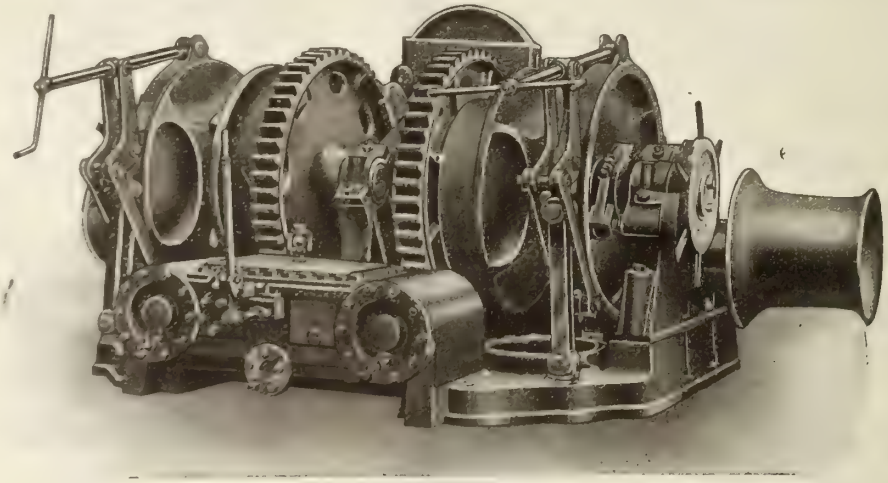

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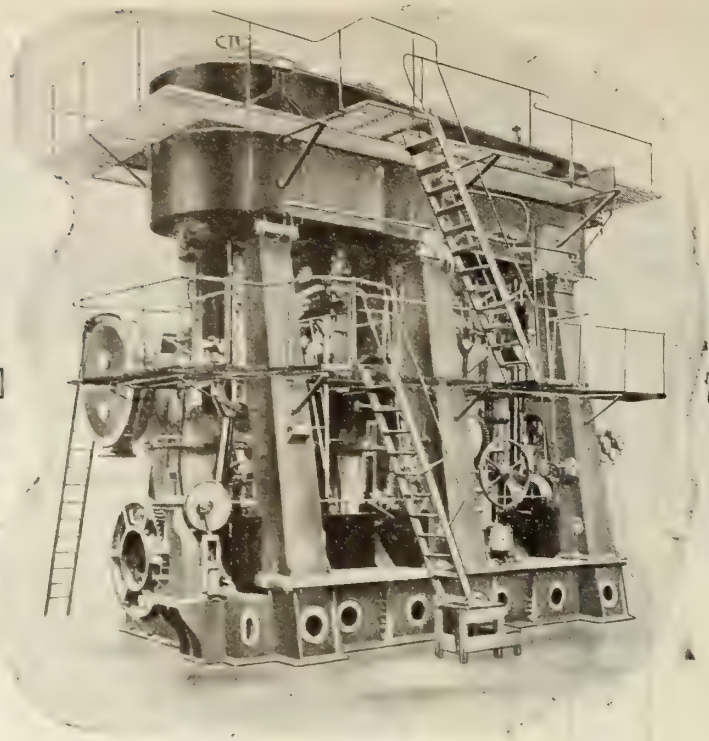

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Vol. XI. JUNE, 1921 No. 6

A Guide to the Canadian Marine Certificate

This Article Is The First Of A Series Dealing With The Knowledge To Be Acquired By Candidates For Second And First Class Marine Certificates. This Article ReviewsVulgar Fractions.

By T. H. FENNER

SOME of the readers of Marine Engineering who are also readers of Power House, have asked us why we do not run a course of instruction for marine engineers such as we have been doing for the stationary engineers in Power House. We have thought of so doing, for some little time, and the number of requests received have determined us to begin.

The amount of knowledge required of the marine engineer these days is considerable, especially if he wishes to qualify for a chief engineer's certificate good in the United Kingdom. The requirements for the certificate of third and fourth class are mostly of a practical nature and are based on the amount of experience the candidate must of necessity have before he sits for the examination. For the higher certificate it is necessary to have a knowledge of arithmetic up to and including square and cube roots, decimals and fractions, which are, of course, the elementary principles of the science of mathematics. Mensuration sufficient to enable a man to work out areas of bunkers, boilers, segments, etc., is required. There is nothing that would be a stumbling block to the ordinary man in any of these things, but a good many men allow their knowledge to get rusty in the interval between school and their ambition to become chief engineers, so that it is well to start from the beginning. We shall, therefore, devote the preliminary portion of these articles to a brief review of fractions, decimals, cube root, square root, and some mensuration, and then take up systematically the work required for the second and first-class certificates. The articles will appear each month, and will be of sufficient length to give the reader something to work over until the appearance of the succeeding article.

The author will be very pleased to receive any comments or criticism which may appear necessary to any of our readers, for only in that way can he be assured that the articles are meeting the requirements of the student. Having been through the mill, from a five and a half years' apprenticeship in shop and drawing office, some seven years at sea, and the possession of an Extra First Class B. O. T. certificate, coupled with some thirteen years' engineering experience in Canada, the writer feels that he knows just what a man requires, and the success that he has met with in writing a course for the stationary engineers encourages him to do the same for the marine men.

We have known a good many men, who were first-class men in the engine room, but seemed to lose all their nerve when faced by an examiner. There is no need for any man to feel afraid of an examination if he knows his work. While the necessary technical knowledge may sometimes seem difficult of acquirement to the man who has not given it much consideration, we can assure him that it only requires steady application. Without technical knowledge in these days a man can not expect to get anywhere in the profession of engineering, and he owes it to himself to do all he can to obtain it. If there is a technical school within reach, attend it if at all possible. Get books and read them. Think things out when you are standing your watch in the engine room, where you have the visible evidence of the correctness of theory right in front of you. As you gain knowledge of the underlying principles of the machine that you are handling, you will have a new interest in it, and a new respect for those who have made it possible to build it. You will find the acquirement of this knowledge of absorbing interest, and if it is sometimes dull, especially at the beginning, don't get tired and give it up. Nothing worth while is reached without hard work.

Vulgar Fractions.

As it is not possible for us to carry on our daily functions with even numbers of every material, we have to have a means of gathering the odd parts together to make up units. There are two ways of performing this in arithmetic, the first method used being known as vulgar fractions, the second, decimal fractions. In the first method we have a means of adding, subtracting, dividing and multiplying any number of different parts of a whole number, these parts not being of the same dimensions. That is, we can add, subtract, etc., quarters, eighths, sixteenths, forty-thirds, fiftieths, or any other division of a whole number that may occur.

A vulgar, or common fraction, consists of two parts, the numerator and the denominator. The numerator is written on top of a line which divides it from the denominator, and the denominator underneath. Sometimes the dividing line is vertical or diagonal, and in this case the numerator is written on the left hand side and the denominator on the right. The numerator, as may be guessed from its name, denotes the number of parts to be taken, while the denominator denotes the number of parts in the whole number. Thus in the fraction ½, the top figure denotes the number of parts to be taken, while the lower figure denotes the fact that there are two parts in a whole number. Similarly ¾ denotes that out of four parts which go to make up a whole number, three are to be used. If we subtract the numerator from the denominator, the number remaining is the number of parts that must be added to the numerator to make a whole number. Thus in the fraction ¾, if we take 3 from 4 we have 1 remaining, and if we add 1 to 3 we have 4, which is the number of parts in the whole number.

Vulgar fractions may be simple, compound, proper or improper. A proper fraction is one that is less than a whole number, such as ½ or ¾ or ¼, while an improper fraction is one where the numerator is greater than the denominator, as for instance, 4/3 or 3/2 or 16/15. A simple fraction is one, which contains only a numerator or denominator, such as ¼ or ¾, while a compound fraction may contain several terms, such as:

$$\frac{\frac{3}{4}}{\frac{7}{8}} \quad \frac{\frac{1}{2}\left(\frac{7}{8}+\frac{1}{3}\right)}{\frac{3}{4}\left(\frac{9}{12}+\frac{7}{8}\right)} \div \frac{15}{16}$$

Having defined the various kinds of fractions we can start in on the more simple operations, and explain them as we go along, gradually leading up to the more difficult examples.

Addition of Fractions

The preliminary operation in any study of arithmetic is addition, so we shall start in with addition of simple proper fractions. Suppose we have to add together the following:

$$\frac{3}{4}+\frac{7}{8}+\frac{15}{16}+\frac{9}{32}$$ (3)

We cannot add these different fractions together directly in the form they are in, as the denominators are all different. We must reduce them all to a form in which they can be compared, and we can do this only by making them all the same kind of parts. That is, they must have all the same denominator. To do this we must find what is called the least common denominator, and this is a number into which all the different denominators can be divided without leaving any remainder. To do this, write down all the denominators in the same order in which they appear in the sum. See if the first one will divide into the others without any remainder, thus:

4. 8. 16. 32.

4 | 8. 16. 32

2. | 4. 8

2. | 4

2 (11)

Now take the first figure of the quotients, which is 2, and divide it into the remaining quotients. Repeat this operation as often as possible, until there is only one quotient left. Then multiply all the divisors and the remaining quotient together, thus:

$4\times2\times2\times2=32$ (5)

The product of this is the new denominator. This result would have been attained by inspection if familiar with this work, but it is better to follow it out to begin with, because there are many cases where the result cannot be obtained by inspection.

We have now got a new denominator, and the next step is to reduce all the fractions to terms of the new denominator, and add them all together. In order to do this, we take the denominator of the first fraction and divide it into the new common denominator. Then multiply the numerator of the first fraction by the quotient obtained. The fraction is thus expressed in terms of the new denominator. For instance, the common denominator is 32. The first denominator is 4 and the first numerator 3. We divide 4 into 32 and multiply 3 by the quotient 8, and we thus have a numerator of 24 and a denominator of 32. The next term gives 8 into 32= 4, and $7\times4=28$, and so on. The new sum will be:

$$\frac{24}{32}+\frac{28}{32}+\frac{30}{32}+\frac{9}{32}$$ (6)

And for convenience it is written:

$$\frac{24+28+30+9}{32}$$ (4)

Now all that is needed is to add all the numerators together, and their sum is set above the common denominator. The result is an improper fraction. This is reduced to a whole number and a proper fraction by dividing the denominator into the numerator, and setting down the quotient as a whole number and the remainder as a fraction with the same denominator.

$$\frac{91}{32}=2\frac{27}{32}$$ (18)

The foregoing is a simple case, and as we said, anyone familiar with fractions would have seen the answer by inspection. We will take a little more complicated case to illustrate this principle again. Add together:

$$\frac{3}{42}\ \frac{8}{54}\ \frac{9}{20}\ \frac{3}{7}$$ (9)

Find the least common denominator. 7 will go into 42 and the quotient 6 will again go into 54 nine times. No further division is possible, so we multiply to get the new denominator.

7 | 42. 54. 20

6 | 54. 20

9 20 (10)

This is:

$7\times6\times9\times20$ (10)

We could have set it down in a simpler manner by putting down the various denominators and cancelling those out that will divide equally as follows:

42. 54. 20. 7

6 9 20 7 (12)

$$\frac{540+1120+3402+3240}{7560}$$

$$=\frac{8482}{7560}=1\frac{922}{7560}$$ (13)

In any ordinary fraction it soon becomes easy to determine the denominator by inspection. For instance, when making measurements with a straightedge the addition is made mentally, such as 5/8, 1/16, and 1/32 is 23-/32.

Subtraction of Fractions

Subtraction of fractions is performed in exactly the same way as addition as far as the least common denominator is concerned. Suppose we wish to subtract ¾ from 15/16th. We see at once that 16 is the L.C.D. (least common denominator). The sum by inspection is 12/16ths subtracted from 15/16ths, and the result is 3/16ths. Take another case: 13/16—3/20. Here 16 will not go into 20, but 4 will go into both 16 and 20. Thus we have a divisor of and a quotient of 4 and 5, and the new common denominator will be $4\times4\times5=80$. This method of taking an outside number is very useful, and can often be employed to advantage. Take the case, 7/15, 8/21 and 9/12. None of these numbers will divide into each other, but 3 will.

Take again, 7/8, 9/20, 18/42, 16/34, 8/50. None of these will divide into each other, but inspection shows that 4 will divide into the first two terms. We proceed as follows: Take 4 as the first divisor, and set down the quotients of those terms that can be divided and the terms that cannot be divided on the second line. The second line then contains two terms that can be divided by 5 and this leaves three terms that can be divided by 2. Now take all the remaining quotients and the divisors and multiply them together, and we have the new denominator. The denominator is:

8. 20. 42. 34. 50.

4 | 8 20. 42. 34. 50

5 | 2. 5. 42. 34. 50

2 | 2. 1. 42. 34. 10

1. 1. 21. 34. 5

$1\times1\times21\times34\times5\times4\times5\times2$

$=142800$ (14)

This is a big number, but nothing like the figure that would have resulted had we not brought the terms down as low as possible.

Next take a term that contains both addition and subtraction. Find the sum of:

$$\frac{7}{8}+\frac{9}{16}+\frac{3}{4}-\frac{1}{2}-\frac{3}{16}-\frac{1}{4} \quad (15)$$

Thee first step is to determine the L.C.D. Inspection shows that it is 16 and the sum becomes:

$$\frac{14+9+12-8-3-4}{16} \quad (16)$$

To solve this expression, we take all the terms with a plus sign and all the terms with a minus sign, and add all terms of like signs together. Then the sum of the terms with minus signs is subtracted from the sum of the terms with plus signs. A term that has no sign before it is always understood to be a plus term. We have then:

$$14+9+12=35$$
$$-8-3-4=-15 \quad (17)$$

And the statement becomes:

$$\frac{35-15}{16}=\frac{20}{16}=1\frac{1}{4} \quad (18)$$

Take another case, for example:

$$\frac{5}{12}-\frac{7}{8}+\frac{9}{32}+\frac{7}{42}-\frac{3}{4}-\frac{15}{16}+\frac{1}{64} \quad (19)$$

The L.C.D. will be:

$$\begin{array}{l|l} 1 & 2.8.32.42.4.16.64 \\ \hline 4 & 2.8.2.42.4.1.4 \\ 3 & 2.2.2.42.4.1.1 \\ 2 & 1.2.2.14.1.1.1 \\ & 1.1.1.7.1.1.1 \end{array}$$

$$16\times4\times3\times2\times7=2688 \quad (20)$$

The sum will be:

$$\frac{1492-2527+756+448-2013-2520+4}{2688} \quad (21)$$

Adding like signs together and subtracting, we get:

Now it will be noticed that the figure with the minus sign will be larger than that with the plus sign. That means that the answer will be a minus quantity.

$$1492+756+448+42=3038$$
$$-2527-2013-2520=-7060$$
$$\frac{3038-7060}{2688}$$
$$\frac{-7060+3038}{2688}=\frac{4022}{2688}$$
$$-1\frac{1334}{2688} \quad (22)$$

(To be Continued)

SHIPBUILDING IN 1920.

With a coast line of such tremendous length on both Atlantic and Pacific, and the most extensive fishing grounds in the world, it is but natural that shipbuilding should be an important industry to the Dominion of Canada. At the end of the year 1918, when a survey was conducted by the Dominion Bureau of Statistics of figures of manufacture, it came within the first ten industries with capitalization of $56,229,033 and an output of $74,799,411, and has doubtless since that time assumed a higher place relatively due to the decline of what were purely war activities which had developed abnormally, and the successful building years of 1919 and 1920. Canada has now attained third place amongst the nations of the world as a shipbuilding country

According to announcement by the Department of Marine and Fisheries, the gross tonnage built in 1920 was 204,635 tons, representing 351 vessels of one kind and another. Vessels built and registered in Canada during 1920 numbered 329, of which 121 were sailing vessels, 53 wooden steam vessels, 119 wooden gas vessels, 35 steam metal vessels and one gas metal vessel. Steam metal vessels accounted for 120,127 tons; wooden sailing vessels, 22,758; steam wooden vessels, 12,829 tons; gas wooden vessels, 3,495 tons; gas metal vessels 116 tons— a total of 159,325 gas tons.

Quebec Led in Tonnage.

Vessels built but not registered in Canada during the year were 22 in number. Thirteen were wooden steam vessels of 13,829 tons; 9 steel steam vessels of 31,135 tons; and one wooden sailing vessel of 348 tons.

British Columbia with 138 vessels to her credit led the provinces in the number turned out, but Quebec, though credited with only 96 vessels, led in gross tonnage with 103,339 tons as compared with British Columbia's 66,561 tons. Nova Scotia turned out 90 vessels, almost all small; Ontario is credited with 17 vessels; New Brunswick accounted for 5; Prince Edward Island 4; and Saskatchewan 1. Alberta and Manitoba do not appear at all in these returns, their activities being confined to lake and river boats.

At the 31st of December 1920, there were 7,909 vessels of all kinds on the Canadian register, of which 3,623 were sailing and 4,281 operated by steam. The gross tonnage of sailing vessels was 505,630 and of steam 1,105,010 tons, making a total tonnage of 1,610,640 gross and 1,151,880 net tons.

MECHANICAL HANDLING IN WAREHOUSES

One of the most complete equipments in the world for the handling of goods is to be found at the warehouse of the Port of Manchester, England. It includes cranes, electric runways, gravity conveyors, electric battery trucks and electric "tiering" devices. The gravity conveyor consists of an inclined plane with rollers down which crates and other packages can be slid. It is in a portable form, and by means of it as many as three thousand packages can be dealt with in one day. The tiering machine is used for stacking bales of cotton, cases of lemons, and similar packages. A vertical ladder-like arrangement carries a horizontal platform which is raised and lowered by means of an electric motor. The whole machine can be moved from one place to another and it is capable of lifting a load of 1,500 pounds. The electric runways consist of overhead rails from which hang electric grabs which pick up casks and so on, and transport them to the place of storage in a minimum of time.

A COMPACT PETROL-DRIVEN GENERATOR

Partly as a result of developments in connection with aircraft, a marked advance has been made recently in the production of very light and compact petrol-driven electric generators by British firms. As an example, a combined set capable of producing 300 watts weighs only 55 pounds. The engine is air-cooled and is able to give a continuous output of 600 watts if run at 2,500 revolutions per minute instead of at the normal speed of 1,700 revolutions per minute. At a pinch, the engine can be safely run up to 3,400 revolutions without undue heating. The set is intended for battery charging and consumes only one-tenth of a gallon of petrol for 300 watt hours. It can also be adapted to produce alternating current for X-ray work and similar requirements.

The Ancient History of Ship Regulation

To All Those Who Follow the Sea the Load Line Is an Important Affair—The History of Load Line Regulating From the Earliest Times To Plimsoll Is Given Here.

By SIR WESTCOTT S. ABEL, K. B. E.

The altered maritime conditions consequent upon the discoveries of America and the Indies led to the decay of the Italian and Germanic trading communities, and the disenfranchisement of the Hanseatic League encouraged an immediate growth of British sea-power. Almost contemporaneously both France and Great Britain began to develop systems of maritime law. The most important development was, however, that contained in the famous "Ordinances of the Marine" of Louis XIV., published in 1681, which was brought about at the instigation of Colbert, the celebrated Prime Minister at that time, and which is still regarded as a great authority on all questions of maritime law. Although the inception of official ship measurement was the work of the Italian Republics, yet it was due to this later code of laws that ship registry was introduced. This law provided that "'all ships shall be gauged immediately after they are perfected, by the Viewers or Overseers of the Trade or Mystery of Carpenters, who shall give an attestation of the Burthen of the Ship, which shall be en-registered in the Admiralty-Office," and the clause following states that for the measurement of the burthen and capacity of the ship, the hold shall be measured at the rate of 42 cubic feet to the ton.

In the Lex Mercatoria, compiled by Gerard Malynes, in 1686, which is a summary so far as the author knew of the existing sea laws of the time, a clause is mentioned in Chapter 32, which runs as follows:

"All ships being made for sailing are to be prepared accordingly, both for goodness and fit timber, and convenient building; as for the placing of the rudder of the ship upon the right parallel of the keel of the ship, for therein consisteth a main point for swift sailing."

The authority from which this statement was derived is not, however, known.

The advantages of official registry are so obvious that it is remarkable that laws on the subject should be of comparatively recent origin. It is possible, of course, that the record of registry has been lost, for in some respects English legislation antedated the French law, although it was simply confined to vessels engaged in the specific trade of coal carrying. The earliest English tonnage law is an enactment of King Henry V., in 1422, and states simply "That keels that carry coals at Newcastle shall be measured and marked." Its object was to measure accurately the "'portage" of each keel, and to mark that portage on the vessel so that the King's due of "two pence" per chaldron might be secured. The "chaldron" was a measure of capacity, or "heap measure," and not of weight. With coal cargoes, of course, the two modes of measurement were convertible, and with the stipulated number of chaldrons on board, any keel would float at a certain draught of water, which could be marked on the stem or sternpost.

In the year 1648, a further act stated "That Commissioners should from time to time be appointed by His Majesty, His Heirs and Successors, for the admeasuring and marking all and every the keels and other boats," etc., "to be used for the carriage of coals in the port of Newcastle and all other places within the counties of Northumberland and Durham."

In 1694 deadweight was substituted for chaldron-measure, by an act which reads that the "said admeasurement shall be by a dead weight of Lead or Iron, or otherwise, as shall seem meet to the said Commissioners, allowing three and fifty hundredweight to every chaldron of coals," etc., "and cause the said keels and boats so admeasured to be marked and nailed on each side of the stem and stern and midships thereof," etc., and "provided that no such keel or boat shall be admeasured, marked, or nailed to carry more than ten such chaldrons at any one time." Twenty-six and a half tons was thus the maximum load permitted.

An Act of 1775 (Act 15 Geo. III.) extended this law to vessels used in loading coals "at other ports of Great Britain," and stated that the vessels were to "be admeasured by a deadweight of Lead or Iron, allowing twenty hundred weight avoirdupuois to the ton, and marked and nailed as aforesaid to denote what quantity of coals each will carry up to the mark so set thereon." The vessels coming under the law were limited to harbor or river service, and might fairly be described as sailing barges rather than sea-going ships.

It will be seen that this Act was of importance, since it extended the practice of registry to all other ports in Great Britain, thus removing the legislation from a local to a national sphere. The measurement of vessels continued, however, to be conducted in a very loose manner, and in order to evade the payment of dues and port charges based on tonnage, the registered was usually much below the real tonnage, the difference between the measurement under the Act of William III. and that of George III. being on the average somewhere about one-third of the vesssel's tonnage.

An important development occurred in 1786, when the new Registry Act came into operation. This Act appears to be the first important and comprehensive measure embodying British marine legislation, and required the owner of every decked vessel of fifteen tons and upwards to have her measurement accurately ascertained in accordance with a prescribed scale.

The first British rule of assessing tonnage is contained in the Act of 1694, which was repealed in 1696, wherein the tonnage was determined by the product of the length of straight keel (on the ground), the molded breadth, and the depth of hold, divided by a factor of 94. The Act of 1719-20 was generally similar, except that for depth of hold was substituted the half-breadth. The more generally known tonnage obtained by the "Builders' Old Measurement" formula was promulgated in 1773, and continued in force until about 1835. This law expressed tonnage in terms of the product of length minus three-fifth beam multiplied by breadth multiplied by the half-breadth, divided again by 94. In the opinion of Sir William White, these rules with the factor of 94 were determined with reference to the carrying power of the vessels in tons deadweight, and he puts forward certain arguments to support this reading.

Between the years 1821 and 1854 considerable discussion took place on maritime affairs. An Admiralty Committee investigated the question of tonnage measurement in 1821, and suggested that estimates should be made to the deadweight capacity of the vessels, and a second Commission, in 1833, extended the same principle. In 1836 a Committee of the House of Commons was appointed to inquire into shipwrecks, which reported that the increase in disasters at sea arose from the imperfect classification of vessels prior to the establishment of Lloyd's Register in 1834, and to the bad forms of vessels, arising from evasion of tonnage dues under the defective system of measurement.

The Merchant Shipping Act of 1854 was the outcome of the activities of these Committees, and the adoption of the Moorsom system of tonnage measurement removed the inducements to build vessels of the type encouraged by the Builders' Old Measurement.

As regards measurement of ships, from this time forward it was practically confined to interpretation of the deductions to be made from gross tonnage to arrive

at the net tonnage on which dues are paid, and it is not within the scope of this paper to pursue the subject further, except to remark that from then onwards the question of tonnage has been considered entirely apart from questions of safety of property or life at sea. It should be mentioned in passing that, starting from an International Commission held in Constantinople in 1873, the question of tonnage has been brought, so far as international matters are concerned, to a fairly close agreement.

As regards the load-line for cargo vessels, the first record of the assignment of a limited draught in Great Britain has already been referred to as arising from the Act of 1694 for the marking of coal-carrying vessels in the North of England. The load draught was first inserted in Lloyd's Register Book in 1774, and although the manner of determination cannot now be definitely ascertained, it seems probable that it was obtained by a rough rule of so many inches of freeboard per foot depth of hold. This record was maintained for some 60 years, until, in 1834, Lloyd's Register was constituted on its present basis, when this record was discontinued.

Shortly after this time the Committee of Lloyd's Underwriting Association proposed that a freeboard of three inches per foot depth of hold should be taken as a guide for safe loading. This rule, known as "Lloyd's Rule," was widely used, although it obviously did not permit any differentiation between the seagoing qualities of various sizes and types of vessels. About the same time, also, the Liverpool Underwriters' Association formulated a rule for regulating the loading of first-class vessels. In these rules the allowance per foot depth of hold varied from 2¼ inches for vessels from 10 to 12 feet in depth, to 4 inches for vessels 26 feet in depth, and provision was made, not only for the age, type, and proportions of the vessel, but also for the nature of the cargo, intended voyage, and season of the year.

In 1867 the Institution of Naval Architects issued a report, recommending the adoption of a minimum freeboard, which was presented to Parliament in 1870, concurrently with the introduction of a Bill by the famous Mr. Samuel Plimsoll which required the compulsory assignment of a load-line and the survey of all ships.

In 1871 the Merchant Shipping Code Bill was introduced, which provided for the compulsory marking of the draught of water on the stem and stern of every ship, for recording the draught, and for criminal proceedings to be instituted where unseaworthy vessels were sent to sea. It gave power to the Board of Trade to prevent any ship from proceeding to sea, if in the opinion of the Board's officers, there were defects in her hull liable to render her unseaworthy. Owing to various other pressing matters of legislation, Parliament could not deal with this Bill, and Mr. Plimsoll's second Bill, having the same objects as that of the previous session, suffered a similar fate. Towards the end of that session, however a short act was passed, containing those clauses of the Merchant Shipping Code Bill which related to draught marking and to survey.

"Awning-decked" vesssels, with a continuous deck above the main deck, of much lighter scantling than the main part of the hull, came into existence in 1873, and to prevent their being overloaded the Committee of Lloyd's Register considered it necessary to make the classification conditional upon a maximum load-like being assigned and marked on the sides of the vessel. This was the first instance of a fixed load-line being required by any public institution in England; the marking adopted was a diamond with a bar at each end and the letters L and R above the bars.

As the result of these various activities, led by Mr. Plimsoll, the Royal Commission on Unseaworthy Ships was appointed in 1873. This Commission, which was most impartially constituted, reported, in 1874, that it was unable to recommend any fixed load-line founded on a proportion of freeboard to depth of hull, and the rough rule of three inches of freeboard to every foot of hold, hitherto considered as the measure of safety, could not be recommended as law. The Commission suggested, however, the marking of a vertical scale of feet amidships on the side of the vessel, and the compulsory recording of the load draught of the vessel in the ship's log immediately before she commenced her voyage.

While the Commission was sitting, Parliament passed the Merchant Shipping Act of 1873, requiring the draught and amount of clear side of vessels to be recorded at the time of leaving port, and giving the Board of Trade authority to detain overloaded and improperly loaded vessels.

During the session of 1875, and after considerable discussion, the Merchant Shipping Act of 1875 was passed, which prohibited the carriage of a cargo of which more than one-third consisted of grain and similar goods, unless the grain was secured from shifting by boards or other suitable means. Every British vessel was to be marked permanently on her sides with lines indicating the position of her decks, and the owner of every foreign-going British ship was required to mark upon her sdes, before clearance outwards, a maximum load-line, consisting of a circular disc twelve inches in diameter, so placed that the centre of the disc indicated the maximum load-line in salt water to which the owner intended to load the ship for that voyage. The distance between the centre of the disc and the deck line was to be recorded at the Custom House, and inserted in the agreement with the crew.

In 1876 a more detailed Act was passed, in which these requirements were confirmed, and the compulsory marking of the disc was extended to include all British vessels except those of under 80 tons register engaged exclusively in the coasting trade, fishing boats, and pleasure yachts.

Arising from the Act of 1873, which gave the Board of Trade power to detain overladen ships, it became necessary for rules to be formulated for the guidance of the Board's surveyors, and in 1875 a conference was arranged between representatives at the Board of Trade, Lloyd's Register, and the Liverpool Underwriters' Registry. This conference broke up without coming to any definite conclusions; the fundamental principles necessary to be considered in dealing with the question of load-line were, however, elucidated and clearly stated.

In 1882 the Board of Trade found it imperatively urgent to give some guidance to their surveyors, and a set of freeboard tables were prepared. At the same time, Lloyd's Register had been independently investigating the matter, and, in August of that year, the Society issued their first tables of freeboard.

In 1883 the Board of Trade appointed the first Load-line Committee, which reported, in 1885, that it was practicable to frame general rules for freeboard assignment, without undue interference with trade. They submitted tables, giving the maximum loading which could be permitted in cargo vessels, which were mainly based on those issued by Lloyd's Register in 1882. The report of this Committee was communicated to other maritime countries, with a view to a common understanding being arrived at as to the depth to which all merchant vessels should be loaded.

The Merchant Shipping (Load-Line Act, passed in 1890, substituted the compulsory marking of a freeboard under the tables of the 1883-5 Load-Line Committee for the load-line to be marked at the owners' discretion under the Act of 1876. The various Institutions for the survey and registry of ships were empowered to represent the Board of Trade in the assigning of freeboards, and provision was made for the future modification of the freeboard tables.

In 1898 it was found necessary to modify these tables with regard to the North Atlantic Winter Freeboard, and to make provision for larger ships and for the new type of "turret-decked" vesssel. It was, however, recognized that a more complete revision was required, since the structural efficiency of ships continued to increase.

Various inquiries were made by foreign Governments respecting the working of the British Load-Line Rules, and when, in 1903, the German Government issued a set of load-line tables on a similar basis to the British, the suggestions for the modification of the British Rules speedily crystallized. The German regulations could not be regarded as equally effective with the British tables, but negotiations were in-

...ject. While these were in progress, the Merchant Shipping Act of 1906 was passed, under which it was required that foreign ships using ports of the United Kingdom should be subjected to the same load-line marking as British ships. This law was to become effective in 1909.

Also in 1906, the Board of Trade issued, with the concurrence and advice of the various classification societies, the revised Tables of Freeboard, allowing vessels complying with modern requirements to load more deeply than under the old tables, but increasing the freeboards of vessels not fulfilling these requirements.

The negotiations with Germany culminated in 1907, when a conference of experts of the two countries was held, and the German tables were modified to permit of their being recognized by Great Britain. The conference resulted in an Order in Council, which became effective in 1909, recognizing German freeboard certificates, and a similar decree in Germany accepting the certificates issued to British ships by the Board of Trade or the recognized classification societies.

Conferences were also held with various other maritime powers on the question of a compulsory load-line, and the revised tables of 1906 were the standard for discussion. The principles of these tables were adopted by all maritime powers having a compulsory load-line, and their regulations were in the main, little more than translations of the British tables.

The Load-Line Committee of 1913 was appointed primarily to formulate a set of rules for international acceptance. The work of this Committe was of importance in facilitating the calculations involved in freeboard assignment, and in dissipating the rumors which had been current to the effect that the reduced freeboards permitted by the revision of 1906 had led to increased losses of ships and men. The report of this committee has not yet been adopted by Great Britain or any other maritime country.

In passing, it may be mentioned that in the year 1874, owing to the increased casualties attributable to spontaneous combustion of coal cargoes, the first Royal Commission was appointed to deal with the subject.

Definite action with regard to safety of life at sea appears to have commenced with the report of the Committee of the House of Commons, appointed in 1843, which recommended the official survey of passenger ships and a compulsory equipment of lifeboats and life-saving appliances, and in 1887 the Select Committee was appointed to consider life-saving appliances, and this body advocated the introduction of regulations as to the number of boats to be carried and the official ...of life-saving appliances. This Committee further deputed power to the ...Board of Trade ... new regulations from time to time, provided a period of objection before adoption be permitted to the Houses of Parliament. This Committee gave the first recommendation on the subject of subdivision : it stated that the value of life-saving appliances was largely dependent on the provision made for keeping the vessel afloat for some time after an accident had occurred. Following the passing of the Life-Saving Appliances Act of 1888, a Board of Trade Committee was appointed which decided that the scale of numbers of boats could be reduced if vessels were sufficiently sub-divided, and, in accordance with their recommendation, a Technical Committee on the Spacing and Construction of Water-Tight Bulkheads was appointed in 1890, which laid down the basis of subsequent developments of the subject.

In view of the growth in the size of vessels, a further Committee on Life-Saving Appliances was appointed in 1911, which suggested that the requirements as to subdivision formulated by the 1890 Committee should be revised.

The Merchant Shipping Advisory Committee issued a report in 1912 on the general question of safety at sea, and in the following year a Departmental Committee was appointed on boats and davits, which dealt in considerable detail with the modern developments of the question.

The loss of the "Titanic" drew general attention to the question, and a Departmental Committee on Bulkheads and Water-Tight Compartments was appointed in 1912, and an International Convention on safety at sea was held in London in November, 1913.

This Departmental Committee investigated the subject at great length, and reported in November, 1914.

The International Conference signed, in January, 1914, a convention agreeing on general principles involved in the administration of the regulations of the subject of safety at sea—a document which is without parallel in the history of sea legislation.

It was not the original intention of the author to deal with the more recent developments, but it is thought that it would be of help to further study of the subject if a condensed account were given of the more important landmarks in modern history.

The author is considerably indebted to Mr. R. S. Johnson and to Mr. R. Y. Sander for their help in connection with the research involved in this paper.

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PROBLEMS OF COLD STORAGE

How much of the world's food supply is now kept in cold storage is difficult to say, but it must form a very large part of the total of perishable foodstuffs. It is not surprising, therefore, that the problem of getting the atmospheric conditions in cold storage premises exactly right for the long preservation of food has attracted the attention of the scientific mind. One phase of the problem is to secure the right degree of humidity or dampness in the atmosphere. For ordinary weather readings a wet and dry bulb thermometer is used, but in cold stores it is not reliable unless it is in a constant draught. An instrument recently exhibited before the Royal Society of Great Britain has a wet and dry bulb mounted in a tube through which a tiny electric motor draws a current of air. In another dampness measurer, designed to give a reading at a distance, the dampness affects a hair, to which a pointer is hung. The principle is the same as in the old familiar "weather house" with doors through which a man or a woman emerged, according to whether the air was dry or damp. In this instrument, however, the pointer moves over a drum which is really a resistance coil, and the degree of dampness is ascertained by measuring the electrical resistance at the point where the pointer is in contact with the coil.

A Novel Scheme For Salving Sunken Ships.

A BOSTON engineer claims to have solved the problem of recovering all manner of ships sunk in deep water. In proof of his claims, he has installed at 149 Causeway street, Boston, an eighteen-foot tank in which he gives, in detail, an interesting and practical demonstration of the raising of submerged vessels by means of his invention.

THE SALVAGER GOING INTO ACTION

The inventor claims that a full-size Twin Submersible Salvager will raise wooden, concrete, or steel vessels of all tonnage within twenty-four hours after the vessel has been located.

First, a long tube-like affair, which is called a guiding column, is flexibly attached between the catamaran bows of a securely kedged surface barge or lighter. The free end of this floating column, containing a pivoting trussed iron shoe, is now allowed to submerge and imbed itself at bow of sunken vessel. A sliding key operating in a slotted track longitudinally placed on column accurately guides the bow of the Twin Submersible Salvager in its descent to wreck, regardless of tides, seaway, cross currents and undertows.

The Twin Submersible Salvager consists of two large steel cylinders or pontoons, arranged in parallel. They are connected at either end, and are made to pivot laterally from the center of their connecting arches. This arrangement enables the pontoons to laterally approach each other as Submersible closes, and to recede from each other as the apparatus opens.

Like a dredge on a gigantic scale the Twin Submersible Salvager opens and submerges, bow first. After bow of Submersible guided and held in leash by the guiding column has settled down over the bow of the sunken vessel, the stern of Submersible is then allowed to go down. While submerging, the stern is held in position by cables running from kedged anchors to controls on the stern surface barge.

Powerful triple hydraulic plungers, placed vertically at the bow and stern of the apparatus drive a series of trussed steel supporting arms through the silt and beneath the vessel's bottom, during the process of the closing of the apparatus. These supporting arms are flexibly attached to the inner side of the bottom of each pontoon. Their inward ends are drawn upward by cables, hydraulically operated, until each lift or arm registers with the contour of the vessel's bottom. In this way, by making each supporting arm lift a proportionate weight of the wreck, the vessel is safe guarded from injury while being brought to the surface.

THE SALVAGER IN POSITION

As the Submersible goes down bow first and comes up stern first, it has a lateral and longitudinal stability that makes it positively non-capsizable. The inventor, John A. De Vito, of Boston, claims that it is designed on scientific principles, is free from doubtful arrangements, is seaworthy and reliable. Ships lost years ago and partly buried in the sand or silt offer no impediment to their being raised. All operations are conducted from the surface, and divers when used will be employed for observation purposes only. The Twin Submersible Salvager is patented in Maritime countries, other patents and rights pending.

AUTOMATIC LOCK CONTROL.

For controlling the locks of the six-mile industrial canal being built for the Port Commission of New Orleans, a small electrically operated miniature canal switchboard has just been perfected. Quite out of the sight of the canal itself, one man as operator can control the movements of the lock machinery and have before his eyes just what is happening on the actual canal when he turns the control handles.

The miniature canal, or control board, is sixteen and one-half feet in length, and is rated at 110-220 volts. In solving the problem of lock control the engineers so designed the switchboard as to show in miniature the actual operation of all main apparatus; also to indicate the level of water in the lock chamber and the position of all water valves.

The switchboard shows the lock chambers of the canal by a stretch of marble slabs, extending from one end to the other of the control board. At various points along the line of this miniature canal, columns rise to various heights. These columns are scaled for reading, and indicate the rise and fall of water in the lock chambers when the operator, by means of the control handles, opens and closes the water gates in the actual canal.

On top and near the edges of the board are located the control handles. These handles are operated through an angle of 90 degrees. They open and close the circuits to the electrical apparatus which works the lock machinery, located in the walls of the locks. Name plates show the "open," "close" and "off" positions of the handles.

A special arrangement was worked out to take care of the question of interlocking.—Scientific American.

RADICAL reductions in freight rates between British Columbia and Puget Sound ports and Australia and New Zealand have been agreed upon by the Canadian Government Mercantile Marine, operating out of Victoria and Vancouver; the General Steamship Corporation, of Seattle, and the Canadian-Australian Royal Mail Line, of Vancouver. The Oceanic Steamship Company, which runs a fleet out of San Francisco, is also a party to the new agreement.

The tariff on canned salmon has been reduced from $25 to $18 a ton; general merchandise from $25 to $20 a ton; box shooks from $15 to $10 a ton; portable houses from $18 to $15; wall board from $18 to $15. The lumber rate, which was recently cut to $20 a 1,000 feet, will remain as it is. The new rate on salmon will go into effect August 1, when the new pack will be ready for shipment. The new tariffs are effective from all Pacific Coast ports to Auckland and Wellington, N. Z., and to Sydney and Melbourne, Australia.

Unable to agree with some of the shipping interests of the northern territory, the San Francisco companies represented at the Westbound Freight Conference, which has been meeting in Seattle, have withdrawn and will form a separate organization of their own in the California port. There is said to be no danger of a rate war, however, as a result of the splitting up of the old conference into three separate bodies, centered respectively at Seattle, San Francisco and Portland, Ore. Summarizing the growth of the disagreement a Seattle man said: "The California members of the conference got it in their heads that they were too big to work with Seattle and Portland, and disbanded their sub-committee. Portland then said she would not work with Seattle with a separate conference in San Francisco, and withdrew from the organization, with the result that there are now three conferences in the westbound trans-Pacific trade. We now have different conferences making rates out of San Francisco, Portland and Seattle. However, all have agreed to maintain the tariff, and there is no danger of a rate war. California has formed the California Westbound Conference. Portland had formed the Columbia River Westbound Conference, and Seattle is the only member of the old Westbound Conference.

"While we have separate conferences for San Francisco, Portland and Seattle, all is harmony on the Atlantic Coast, and the Pacific Coast lines are all represented in the Atlantic-Oriental Conference, which makes overland rates on a competitive basis with Atlantic Far East direct operators. The Seattle conference is composed of the Nippon Yusen Kaisha, the Osaka Shosen Kaisha, Mitsui & Company, Frank Waterhouse & Company, and the Canadian Pacific Steamship Company."

The Pacific Steamship Company and Struthers & Dixon have not rejoined the Westbound Conference, but expect to come in under a new reorganization scheme being considered now. The conference originally embraced all trans-Pacific lines except the Blue Funnel Line, Canadian Robert Dollar Company and the Canadian Government Mercantile Marine.

Depression in Japanese shipping has resulted in closing the Osaka Shipbuilding Company's yards, according to word just received from Japan. These constitute one of the largest yards in Japan. Twelve steamships are now under construction at Osaka, but builders are becoming more and more reluctant to accept orders due to the fall in prices.

The American steamship Wenatchee, of the Pacific Steamship Company fleet, the largest American vessel on the North Pacific, is again in trouble, and engine-room disorders put her out of commission while cruising through the Inland Sea of Southern Japan. The Wenatchee left for the Far East with great ceremony. She carried Major-General Leonard Wood and other distinguished passengers.

The Canadian Navigators Federation of the Pacific Coast has been again reorganized. The head office is located at 1101 Rogers Building, Vancouver, with a branch at 308 Union Bank Building, Victoria, and at the Exchange Building, Prince Rupert. The federation is working under the constitution of the Canadian Merchant Service Guild. The board of management is as follows: President, Captain F. H. Parker; Secretary, Andrew Goodland; Treasurer, Captain O. G. Kinnie; vice-Presidents: Vancouver, Captain W. W. Best; Victoria, Captain T. H. Brown; Prince Rupert, Captain J. H. Mulligan; New Westminster, Captain C. J. House; Nanaimo, Captain D. Martin; Yukon District, Captain J. O. Williams; B. C. Lakes, Captain F. L. Orr. Representatives for ocean-going ships are: Captain H. E. Lawrey; local passenger ships, Lieutenant H. Shadforth, R.N.R.; local freight ships, Captain B. Owen-Jones; Government ships, Captain H. Bilton; licensed pilots, Captain C. J. Harris. The Trustees, who are not members of the Board of Management, are: Captains L. R. W. Beavis, T. S. Guns and J. E. Noel.

Inaugurating the Far Eastern service of the Canadian Government Mercantile Marine, the freighter Canadian Highlander passed out of Victoria early in June. She has a full cargo of lumber and general freight for Kobe, Nuchwang and Taku Bar. The next ship to make the trans-Pacific passage for the C. G. M. M. is the Canadian Skirmisher, which will leave for Australia June 12. Both steamers are oil burners.

The House of Commons at Ottawa has passed a vote of $1,300,000 for the big Federal drydock to be built at Esquimalt, and this amount is expected to cover all costs of construction during the ensuing year, although the total expenditures will probably be in the neighborhood of $5,000,000. Peter Lyall & Sons, contractors for the drydock project, have already carried out considerable preliminary work on the site of the graving basin at Skinner's Cove, but owing to the nature of the operations and the enormous amount of dredging and rock blasting to be undertaken it will be some time before any appreciable progress can be made. The mouth of the cove will be closed in by a giant cofferdam and rock blasting will be a feature of the operations during the next few months. The dredging contract has been sub-let to the Pacific Construction Company and is well under way.

Rumors are current here that the Canadian Pacific Ocean Services are negotiating for the sale of the liner Empress of Japan, which has been in service between British Columbia and

Oriental ports for many years. It is said that the company is considering a proposal to put the vessel on the Calcutta-Hongkong route. The Empress of Japan is one of the best known liners in the Pacific and her arrival with her two sister ships, Empress of India and Empress of China, created a big sensation. The Empress of China was wrecked near Yokohama about five years ago and the Empress of India was sold to an Indian prince as a hospital ship during the war.

Effective May 16, the wharfage charges on through overland export and import freight will be eliminated over the Canadian Pacific Railway docks at Vancouver, according to J. G. McNab, division freight agent for the B. C. Coast Service. The elimination of this charge is undoubtedly caused by similar actions taken at Seattle. The Canadian Pacific Railway has endeavored to meet the competition offered by the American port, and although the elimination of the wharfage charge at the Puget Sound port was effective May 8, the change is practically simultaneous, as no boats arrived until May 16. The charge used to be twenty-five cents weight and measurement, and thirty cents export.

Three ships of the Canadian Government Mercantile Marine, which will ply between Victoria and Vancouver and California ports, are now on their way from Montreal and the service will be inaugurated July 1, according to B. C. Keeley, general superintendent of the Government fleet on this coast. The Canadian Beaver will make the first trip and she will be followed by the Canadian Farmer and the Canadian Rover. The ships were built at the Collingwood yards, their tonnage being 3,981, 3,982 and 4,890 tons respectively. The Canadian national steamships are busier just now than ever, only one of the fifty-two ships composing the fleet being laid up at present. Meanwhile, at Ottawa the House of Parliament is hearing arguments for and against government operation of ships, and during the last few weeks many assertions have been made in favor of Canada's adoption of the same policy respecting ship disposal as the United States Shipping Board. Members advancing this theory hold that the Government has no right to compete with private companies and that its policy has had a tendency to discourage private initiative and investment in the shipping business.

Frank Walters, famous diver, will attempt to salvage the $200,000 of gold that is supposed to be resting under 140 feet of water in the purser's cabin on the steamer Islander, sunk off the coast of Alaska twenty years ago. The depth to which the Islander sank has been the one factor in discouraging divers from the job in the past, but Walters has a long record of salvage work done in unusually deep water and thinks the risk is worth while. Before going north Walters will try to salvage the safe from the steamship Governor, which was sunk in a collision with the West Hartland off Port Townsend.

Sir Alfred Yarrow, noted British shipbuilder and founder of the shipbuilding firm of Yarrow & Company, at Scotstoun on the Clyde, has been a visitor in Victoria during the last few days as a guest of his son, Norman A. Yarrow, managing director of Yarrows', Ltd., the subsidiary firm operating at Esquimalt. Sir Alfred Yarrow, although 79 years old, is remarkably active. He showed much interest in the big drydock being constructed at Esquimalt and predicted great activity in Pacific shipping during the next few years.

According to advices received here lately, the Australian Government has now released all claims to the wooden steamships which it has built during the war in Seattle shipyards. The vessels were of 1,900 to 2,400 tons. The Australian Government operated the vessels for several voyages and then disposed of them to private interests in the United States. The Pacific Motorship Company, of Seattle and San Francisco, was organized to buy the ships for $2,400,000, and paid over $780,000. The Australian Government filed claims for the remainder, tying up the fleet, but later an agreement was reached with the Comyn interests in San Francisco whereby the Australians sold their claim for $125,000, reducing the purchase price to $905,000. The Ocean Motorship Company has now been organized to operate the fleet, with W. E. Gerber, Jr., Ralph Roburg, C. N. Howard, all affiliated with the Comyn interests, as incorporators. There are seven ships in the fleet.

A twice-a-month service between Victoria and Vancouver and the ports of the Orient is now being arranged by the Canadian Pacific Ocean Services. This development has been made possible by the acquisition of the new liner, Empress of Canada and the ex-German liner, to be rechristened the Empress of China. The former name was Prinz Friedrich Wilhelm. The tonnage of the vessel is 17,082; length, 589.9 feet; beam, 68.3 feet; depth, 38.6 feet. She is capable of developing a speed of eighteen knots an hour. Special accommodation is provided for refrigerator storage. The Empress of Canada is scheduled to leave the Clyde shipyards late in the summer and will probably sail from Liverpool to Victoria in September or October by way of the Suez Canal.

Travel has again been resumed to the far North. The Yukon was opened to traffic during the third week in May, the Nasutlin being the first to make the run from the foot of Lake Labarge to Hootalinoua.

The freighter Robert Dollar, of the Canadian Robert Dollar, established a new freight-carrying record for these waters when she left British Columbia ports a few days ago for the Orient with 11,000 tons of cargo in her holds. She is carrying 1,000,000 feet of lumber and 3,500 tons additional cargo, and with a consignment loaded at Seattle the total freight amounts to 14,500 tons. The Robert Dollar was formerly the German ship Kurland and was purchased not long ago by Captain Melville Dollar, who is in charge of the company's interests here. The Canadian Robert Dollar Company, which operates a big saw mill in Dollarton, Burrard Inlet, expects to ship 50,000,000 feet of lumber to China this year, thus reviving a big cargo movement which it developed with notable success before the war.

FOR ECONOMISING PETROL

Many devices have been brought out in Great Britain recently for economising petrol, and conspicuous success has been achieved, one designed to reduce the consumption of this fuel in engines which work for a great part of the time at less than full load—which is the case with motor car engines in general. The economiser, which is automatic in its action and contains only one moving part (an air valve) takes the place of the mixture pipe and can be used in conjunction with any carburetter. It consists of a heating chamber, where the fuel is efficiently vaporised, and an air valve to dilute the mixture with heated air to suit all conditions of partial load. The heating is done by exhaust gases.

FROM COAL TO OIL

During the recent coal strike in Great Britain remarkable activity was shown in adapting boilers in power stations to oil-firing in order to supplement the diminishing stocks of coal. Within a few weeks oil burners were constructed and fitted to the boilers, and arrangements made for pumping the oil. At one large generating station in London oil lighters with a capacity of 250 tons each were moored alongside the station and the oil pumped directly from them into a small tank from which the oil-burners were fed. As many as sixteen large boilers were converted to oil-firing in this station within four weeks. The rapidity of this emergency work revealed once more the resource of the British engineer when faced with an apparently insurmountable difficulty. Extensive conversions of the same type have been carried out on British railway locomotives.

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The 8-Hour Day at Sea

AN INQUIRY has recently been made by the International Labor Office into the effect of the eight-hour day as applied to vessels hailing from French ports, which has now been in operation for about one year. As was to be expected, the act has resulted in much heavier costs to shipowners, and especially to those who are least able to bear them, that is, owners of small coasters and foreign-going cargo vessels of medium size. The effect of introducing the three-watch system into these small vessels, especially those engaged in the trade between England and France, which absorbs a large part of the French mercantile marine, was to increase the crew fifty per cent. in many cases. That is, where six men were formerly carried, nine had to be shipped to comply with law. Again, the task of heaving up ashes which, necessarily must be performed outside of the regular hours, has to be paid by overtime. The result in general has been an increase in the cost of running vessels, at a time when the revenue to be derived from them is decreasing very rapidly. The French Government, through the Minister of Marine, admits this to be the case, but takes the view that in the case of merchant sailors and their welfare social conditions should be considered before financial ones. They further think that the act should be continued, but, in order that French shipowners shall not be at any disadvantage, that all other nations should be put under the same law. This is quite a good argument, but one, we are afraid, that will not be subscribed to by the other nations affected. We are among those who think that the whole question of overtime at sea is fundamentally wrong. A man signs on a ship at a certain rate of pay per month, and that rate of pay should be and is in these days adequate as compared with what the same type of man could earn ashore. In addition to the wages, the man has a home and his food is provided, and in the case of officers and engineers, generally they are provided with bedding and service. When a man is at sea he can be in no hurry to get away from work to g to any particular place, except his bunk, and when the necessity arises for work to be done outside of the regular hours of watch, it is usually of a nature that must be performed for the good of the whole ship's crew. Why then should a man require to be paid overtime?

A donkeyman who works in port long hours before the rest of the crew turn to, and after they are finished for the night, is entitled to overtime, and in the British mercantile marine, practically always gets it. We never remember in our experience at sea an engineer being paid overtime although it is done in some special cases, but there are several trades where the officers get paid overtime or extra pay for special cargo work performed in port. There are cases of this kind where perhaps overtime is perfectly legitimate and could not be objected to.

We believe that the demand for overtime at sea is an utterly unreasonable one, and we speak with full knowledge of the situation. In our time at sea we have perhaps put in as much work outside of our regular watch as any man, but the idea that overtime should be paid for it never occurred to us. We have in common with many other engineers we know of, voluntarily performed work outside of working hours when in port for the sake of the added comfort we would get at sea through that work being done, and also because we felt an interest in the property we were in charge of, and a professional pride in keeping it in the best possible condition.

As far as the firemen are concerned, it is usual in long voyage vessels for them to have four hours on and eight hours off, and there is of course a certain amount of time when off watch for heaving ashes, where there is no ash ejector in the ship. The deck men usually work four hours on and four off, except those who are on the usual day work, which is 7 to 8, 8:30 to 12, and 1 to 5. It must be remembered that a sailor when on watch is usually two hours at the wheel and two hours on the look-out or standing by, and is not very hard worked.

In the present state of shipping the adoption of an universal eight-hour day would be an unwarranted and unnecessary hardship, which would affect world trade in much the same manner that exorbitant railway rates affect national trade.

The Death of the Diver

A DIVER working at a depth of only twenty-five feet was drowned recently through a defect in his apparatus and the misunderstanding of signals given by tugs on the life line. It seems strange that with the modern appliances available to make this always hazardous business less dangerous, that the only means of signalling should be the ancient method of giving pulls on a life-line. The reports of the accident give the cause as a leak between the junction of helmet and the collar of the dress, and state that when the diver signalled to be pulled up, that owing to the lines being fouled, the signals were not understood. When absence of any signals caused alarm to the attendants the diver was pulled up dead. Modern diving equipment includes a telephone by which the diver can communicate instantly with his attendants, and this is in addition to the signal line. Had such means of communication been available this tragic death could have been averted. A leak of the kind mentioned would give ample time to haul the man up, and in any case at such a slight depth, a little higher air pressure would have been sufficient to keep the water out until the diver could reach the surface. We would think that it would be compulsory to employ every known method of safe-guarding the life of men engaged in this necessary, but dangerous duty, regardless of any objection raised either by employers or the men themselves, who are sometimes very conservative in the matter of adopting modern inventions in their daily work.

News of The Shipping World

THE RECENT fire at Halifax on the waters of the harbor emphasises the need for preventive measures where docks and harbors are being used by oil carriers and oil burners. The fire in question was caused by refuse oil that had been pumped from the tanker "Impoco" into the harbor being set on fire probably by a lighted match or cigarette thrown from a passing ferryboat. The fire was most spectacular, and caused great alarm among the citizenry, whose nerves are still somewhat taut after the disastrous experience of 1917. Fortunately, the wind was off shore and very light, or the whole water-front might have been destroyed. Those who know the water-front of Halifax might not look on this as an unmixed catastrophe, but the population undoubtedly would. Shipowners and harbor authorities in Great Britain have been discussing this whole question of danger from floating oil, and means of lessening it. The plan of providing receptacles into which refuse oil could be pumped has been much favored, these, of course, being in the nature of floating dump barges. There is no question but that the danger is an ever increasing one, from the continually increasing number of oil tankers and oil burners using the harbors of the world, and concerted effort will have to be displayed to reach a definite understanding and agreement on safety measures.

THE RECENT meeting of the Royal Mail Steam Packet Company held in London was the occasion for some cheerful words from Sir Owen Phillipps, the chairman of the company. The Royal Mail Steam Packet Company from its position in the mercantile marine world, naturally focuses a lot of attention when its affairs are discussed. The company owns over two million tons of shipping, one-ninth of the tonnage of the entire mercantile marine. Sir Owen Phillipps called attention to the price of coal, which rose to the unprecedented figure of 120s. ($30) but has now dropped from that high level, but he insisted that coal will have to come back to the neighborhood of one pound per ton before Great Britain can regain the markets she has lost due to high prices. The subject of Government fleets was mentioned, and the fact emphasised that this was a form of competition that was particularly hard to meet, as when these Government-owned vessels made a loss, the taxpayers of the country which owned them had to make it up. This is a point which should be appreciated in Canada, and also to a greater degree in the U. S. The principal interest to those outside the shareholders of the company lies in Sir Owen Phillips' opinion on the future outlook, which contains considerable grains of comfort not only to the immediate addressees but to all those interested in the shipping situation. Following is the speech:—

"Last February when addressing the Chamber of Shipping of the United Kingdom upon my appointment as president for the year, I pointed out that the total world's tonnage at that time exceeded by ten million tons the amount afloat just prior to the war. The actual tonnage of the world in the water today is some eleven million tons more than in July, 1914, or an increase over pre-war figures of about 24 per cent. The amount of tonnage of all nations which is at the present time lying idle in the ports of the world may, I think, be assumed to be not much less than eight million tons gross register, and probably more. All over the world the ports are full of vessels for which no employment is available. Owing to the severe slump in trade, the actual volume of the world's overseas commerce at the moment is less than it was in July, 1914, so that there are still more than sufficient vessels not laid up to carry all the cargo offering. In times like these it is necessary to face facts, and in view of the situation I have mentioned, it might, at first sight, appear as if many years must elapse before shipping again resumes its normal activity and prosperity. Fortunately, however, a ship has a comparatively short life, and after a certain date, although it may continue to be seaworthy, provided sufficient money is expended upon it, it becomes an uneconomic asset and unable to compete in the world's markets with a modern vessel, fitted with the latest and most up-to-date machinery and equipment. Anyone who carefully examines a list of the vessels that now compose the world's fleets cannot help being struck with the facts that at present there is a much larger proportion of old vessels in service than is normally the case. Many vessels are still afloat, which, had it not been for the duration of the great war, would long since have been relegated to the scrap heap. It may be some consolation to shareholders in well-managed shipping companies to know that a very large number of the steamers which now make up the tonnage of the world are considerably more than twenty years of age, and many of these are quite obsolete. It will never pay anyone to keep in repair and commission a large proportion of these old obsolete vessels, and therefore, although they swell the present total tonnage of the world, they may, for all practical purposes, be left out of account. In the case of the older vessels which well-managed steamship companies may still retain in their fleets, these are always written down to break up prices in their books.

"The surplus, or excess, of effective shipping tonnage of the world is nothing like so great as it would appear to be from the figures I have mentioned."

THE DIESEL engine continues to make progress in Great Britain, and the situation as regards coal due to the continued upheavals has probably been of some help. Without any such assistance, however, the adoption of the Diesel has been for some time an assured fact, and what is particularly pleasing is the development of new designs by British manufacturers. There are also at present several passenger boats being fitted with this type of prime mover. One British firm has secured an exclusive license to build the Still engine, which is, as many of our readers are no doubt aware, a combination of oil and steam in one cylinder. The circulating water in the jacket is conducted through a boiler which is heated by the waste gases, and can also be separately fired when necessary. The oil is delivered to the top of the piston and the steam to the bottom, making the engine a double-acting one. Great success is said to have attended the experimental engine built, and a commercial success is confidently looked for.

THE GENERAL reduction of wages accepted by the personnel of the British mercantile marine was arrived at amicably by all branches of the service, with the exception of the catering branch, whose leaders advised them to go out on strike. This included stewards, cooks, bakers and butchers, and if persisted in would have had a serious effect on passenger liners. There was some little inconvenience at the beginning, several steamers having their baggage and stores put on board by workers from the clerical staffs of the company, and in some cases some of these workers sailed with ship. However, the men soon saw the folly of their action, and the weak position they held, and in spite of their leader, have returned to work in large numbers, so much so, that the strike is practically over. It seems to have been a one-man affair, and there are strong signs that

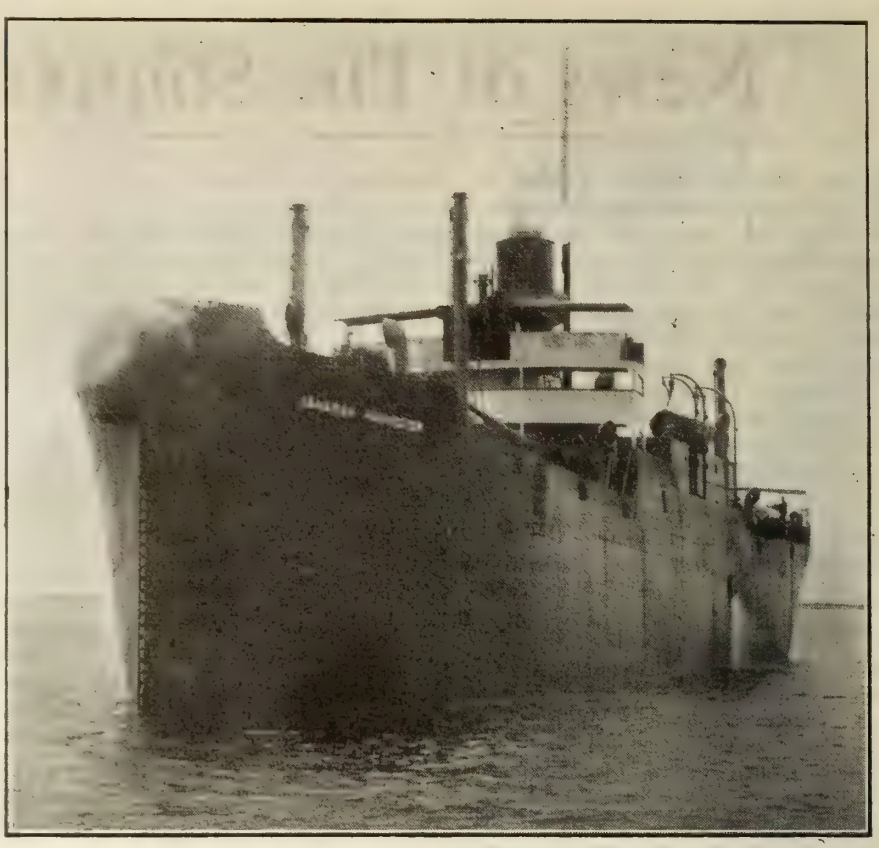
men are beginning to get tired of the everlasting disputes engineered by these professional labor leaders for their own gratification.

ONE OF our oldest shipyards in Ontario has recently completed the last contract that they had for building, and are now only doing repair work in their shipyard and dry dock. The Port Arthur Shipbuilding Company is the firm we allude to, and it is another addition to the ranks of those shipyards with no ships to build, which are too much in evidence in Canada. However, this company has embarked very strongly on the manufacture of pulp and paper machinery, and by this means will be able to keep their staff intact and their plant running profitably till better days come in their line. In the meantime, of course, the repair work will be carried on as usual.

LAUNCHES AT PORT ARTHUR.

The Port Arthur Shipbuilding Company, Ltd., have delivered their last vessel to the Canadian Government Merchant Marine, the vessel in question being the "Canadian Harvester." The "Harvester" is the seventh vessel built by this firm under the Government shipbuilding programme, the others being the "Canadian Trader," "Canadian Adventurer," "Canadian Sailor," "Canadian Sower," "Canadian Runner" and "Canadian Carrier." Five of the vessels were of the 3500-ton class, and two of the 4350-ton. The "Canadian Harvester" was christened by Mrs. Frank H. Keefer, wife of the Federal member for the district of Port Arthur.

The Port Arthur Shipbuilding Company also launched recently the freight steamer "Glenafton" built for the Glen Transportation Company, Ltd., of Midland. She is designed for both lake and ocean service, and has the following dimensions: Length over all, 259 feet; length B.P., 251 feet, 11½ inches; moulded breadth, 42 feet 6 inches, and moulded depth, 21 feet. She has a tonnage of 1866 gross, and an estimated dead weight carrying capacity of 3,000 tons.



THE "CANADIAN HARVESTER"

The completion of these two vessels marks the end of a period of active shipbuilding by this company. There are no new contracts in sight for building, but the dry dock and the shops are being carried on for repair work only. There is always a considerable amount of this work to be done on the lakes, and the favorable position of the company at the head of the lakes, and their very complete equipment ensures a good amount of work falling to their share.

In order to keep the shop equipment at full capacity, the company have gone into the manufacture of a complete line of pulp and paper mill machinery, and digesters. The boiler plant is specially adapted for the manufacture of these latter very necessary articles of paper mill equipment. This will not interfere in any way with the company's main line, which is shipbuilding, and they will be always ready to carry on any building that may be in the market.

THE FREIGHTER "GLENAFTON"

NEW TUG BUILDING.

The Georgian Bay Shipbuilding and Wrecking Co., Midland, are building for the Fisheries Department a wooden tug, 75 feet in length. The launching is scheduled for July. This company recently purchased the old wooden freighter Major, 285 feet length, and it is proposed by D. G. Dobson, the manager, to convert her into a floating drydock to accommodate craft up to 200 feet in length. The bows will be removed, gates inserted and tank and pumping equipment installed. The Midland branch of the Gedley boat concern was recently absorbed by this Midland enterprise, and skiffs, canoes and launches are being built.

Montreal:—The Minister of Marine, Mr. C. C. Ballantyne, sailed for Great Britain on the Empress of France.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

NEW IDEAL PUMP GOVERNOR.

The Ideal Pump Governor, well known in marine circles, has been redesigned. It is now manufactured solely by the Atlas Valve Company, Newark, N. J., whose designing engineers are responsible for the improvements made.

Figs. 1 and 2 show the two principal designs, called Style "A" and Style "B" respectively. Both of these are made for turbine or reciprocating steam-driven pumps. Both styles, also, are approved by the National Board of Supervising Inspectors of Steam Vessels and by the Bureau of Engineering, U. S. Navy Department. Style "A" (Fig. 1) is designed for constant or fixed pressures, whereas Style "B" is made for pressures that may be varied from time to time.

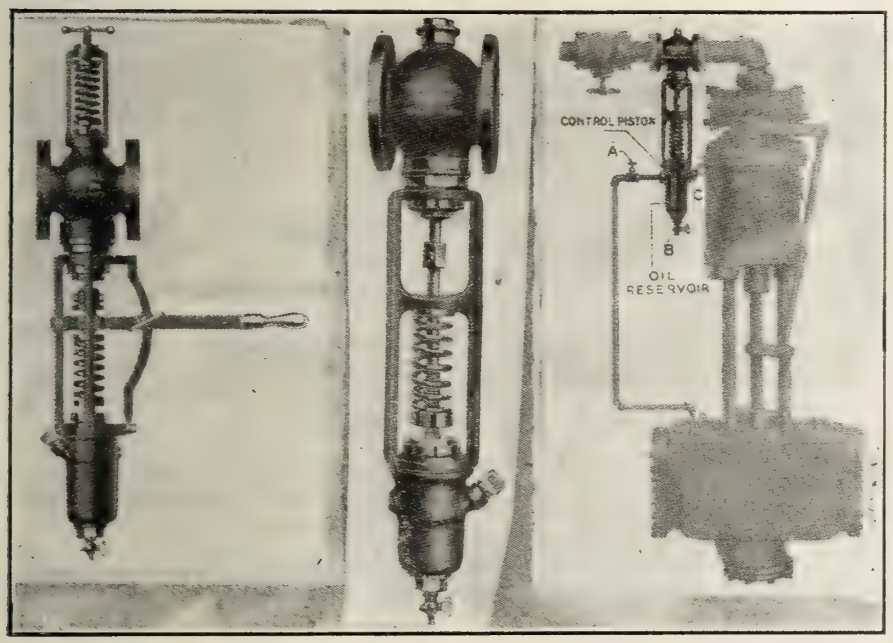


FIG 2 FIG 1 FIG 3

Style "B" (Fig. 2) is equipped with an emergency control lever which provides means for manually operating the governor so that it can be held wide open or be shut off tight, regardless of the pump pressure. Where the pump must deliver an exceptionally high pressure during an emergency, or where pumps must be shut down quickly in case of fire or rupture of the pipe lines, it is evident that this lever adjusting feature is important. It is ready at all times to throw the pump in or out of service as the emergency may require.

This pump governor is of the variable pressure type which can be adjusted to maintain any predetermined pump discharge pressure. At the same time by manipulating the lever an almost instantaneously increased discharge pressure is effected.

The Ideal Governor is piston actuated. It is extremely sensitive, with a patented exclusive feature of an actuating piston operating in a bath of oil. This body of oil not only lubricates the operating piston, but also prevents the liquid being pumped from entering the control cylinder, thus eliminating any possibility of the sticking of the piston due to corrosion, sediment.

The Ideal Governor is very simple in construction and consists of only two moving parts—the steam valve which moves backward and forward within the valve body (which is of the double seated balanced valve type), and the control piston which moves backward and forward in a bath of oil within the control cylinder. There are no diaphragms, cup leather packings or small delicate parts to get out of order.

These governors are installed in the feed line to the pump in a manner as indicated in Fig. 3. Fig. 3 shows Style "A" in place, hence the pump is a constant pressure pump. The control cylinder of this governor is connected through valve "A" and a pipe line to the pump discharge as plainly shown in Fig. 3.

For general use, from three-eighths to two-inch sizes, these governors are made of bronze throughout and for larger sizes up to six-inch they are given iron bodies, trimmed with bronze. For superheated steam they are furnished with steel bodies and monel metal seats and stems.

THE PERFECT WIRE ROPE

To a large extent the user of wire ropes must take them on trust—or, at least, on the faith inspired by the maker's name. And few of them can have any notion of the elaborate and detailed care taken to ensure that a wire rope will not murderously betray the men depending upon its strength at sea, in mines, or on constructional work. The policy adopted by one of the leading British makers of wire ropes will, however, serve to illustrate the fact that there is much more in a wire rope than meets the eye. To begin with, the firm produces all the component parts of the rope from the raw materials in its own factory. It therefore has direct control of everything from A. to Z. The steel for the wire is made in the firm's own steel works and is carefully tested to make sure that it is of the exact quality required. A sample of every "melt" of steel is chemically analysed, and the analysis is filed so that the makers know the precise composition of the steel in every piece of rope that goes out of the factory. All the wire is drawn from steel which passes the test, and it is carefully galvanized. In the laboratory photographs are taken under the microscope to reveal the structure of every piece of wire. Before any coil of wire is used for rope making it has to go through rigid pulling, bending and twisting tests, winding up with a test in which a length of wire is made into a snarl and straightened out again and again until breakage takes place. Many wire ropes have a hempen core to give them greater flexibility, and in making this core the same patient care and supervision are exercised.

Toronto:—A deputation of workmen from the Collingwood Shipbuilding Company, who are completing the two vessels that were under construction by the Dominion Shipbuilding and Repairing Company at the time of their failure, waited on the acting Premier at Ottawa to present a request for the continuance of shipbuilding after the completion of the two vessels. The Government reply was to the effect that they could not authorize any further construction after the completion of the present contracts. The deputation suggested that in view of the deepening of the waterways that the yard should be retained permanently.

MARINE NEWS FROM EVERY SOURCE

Washington:—Senator LaFollette has made a motion in the U. S. Senate for the restoration of package boats on the Great Lakes. These boats were taken off the Lakes during the war, and the Senator claims that the return of the boats would effect a lowering in freight rates on all the Lakes, both in the U. S. and Canada.

* * *

Amherst:—The death is announced of Mr. Aubrey G. Robb, for more than twenty years the chief engineer of the Robb Engineering Works, of this city. Death occurred from blood poisoning, after a short illness. Mr. Robb was secretary of the Maritime Branch of the Canadian Manufacturers' Association for some years.

* * *

Montreal: — During the arbitration proceedings in connection with the Grand Trunk Railway, experts testifying for the Government claimed that the Grand Trunk docks throughout Quebec and Ontario were so badly run down that it would take $500,000 to put them into good condition again. These docks include Levis, Three Rivers, Windsor and Depot Harbor.

* * *

Montreal:—At the enquiry into the stranding of the steamer "Keyingham" at the mouth of the Saguenay, the captain and pilot were exonerated from all blame by the Dominion Wreck Commissioner, Captain Demers. The cause of the stranding was the displacement of the bell buoy, preventing the pilot from seeing it until the ship went aground. There was a fog prevailing at the time of the accident.

Toronto— ... be received by J. A. Cameron, Master-in-Chambers at Osgoode Hall, on the assets of the defunct Dominion Shipbuilding and Repairing Company. These assets include a leasehold on the waterfront from the Harbor Commission, the buildings and plant, shipways and electric cranes. The area held under the lease is thirteen acres, with a frontage of 1868 feet, and has about forty years to run. The buildings and plant represent an investment of about $1,500,000.

* * *

Ottawa—The Department of Marine and Fisheries have issued a statement on the operation of the Canadian Government Merchant Marine since the beginning of the year. The statement shows that 52 vessels were in active commission, and that notwithstanding the depression in shipping which is felt over the world, these ships have shown a substantial profit over operation cost. This result is considered as being very satisfactory when the number of vessels of other nations that are tied up is considered.

* * *

London:—Reports from London state that the first aerial lifeboat is ready for launching. This boat has been constructed under the veil of strict secrecy, and it is said if she proves successful that a large number of much larger boats will be built. The trials will take place with the British Navy. The boat will be able to fly to the rescue of a vessel in distress at the rate of 100 miles per hour, and it is said that when she arrives she can settle on the water and ride out the heaviest Atlantic sea. The wing span of the first boat is 140 feet.

* * *

Halifax:—A spectacular blaze resulted when some oil floating on the surface of the water in the harbor opposite the Halifax Shipyard in some manner got ignited. Heavy clouds of smoke and high flames spread along the water front like magic, and great alarm was felt in the town citizens imagining that another disaster similar to that of 1917 was upon them. Fortunately there was no wind, and the damage was slight. Had there been a high wind the whole city might have been set alight.

* * *

London— Answering questions on the navy estimates in the British House of Commons, Captain Eyre Monsell said that in future all the vessels of the fleet would be oil burners. For this purpose large storage depots were being built all round the British coast. Questioned on the available supply, Capt Monsell said there would no difficulty on this score as the supply would be ample for all ships of the Navy.

* * *

Sault Ste Marie:—Damon S. Godfrey, a diver, employed by the Great Lakes Towing Company, was drowned while at his work on the bottom of Georgiam Bay, near Little Current, Ont. In some manner his helmet began to leak at the connection to the dress, and the dress began to fill with water. He signalled to be pulled up, but the signal line being entangled, the message was misunderstood, and when finally the attendants, being alarmed at receiving no signals at all, pulled him up, life was extinct.

* * *

Toronto:—The annual grant of $3,000 given by the Dominion Government towards the upkeep of the life saving station at Toronto is to be withdrawn. This fact was brought to notice at the enquiry into a double drowning fatality in the harbor, and it was decided that the city take up with the Harbor Commission the question of having the grant continued.

* * *

Victoria, B. C.:—The Dominion Government has announced, through H. A. Barrett, the government inspector, that it will take over the yard and unfinished ships of the Victoria Shipowners, Ltd., which has been at a standstill for the past six months, and complete the programme.

* * *

St John N.B.:— Captain T Pickford, late of the Head Line steamer, Kinbane Head, died recently at New Orleans. He was well known in the port of St John, having been in command of the Carrigan Head during the War, and was responsible for the sinking of several submarines. The late Captain held the rank of Commander in the Royal Naval Reserve.

CATALOGUE

The Dake Engine Company, Grand Haven, Mich., have issued a new general catalogue No. 28, dealing with their steam and air hoists and marine machinery. The catalogue is well printed on heavy paper, and the various machines are clearly illustrated. The Dake steam or air motor and reversing valve are well described. The lines include hoisting engines, winches, capstans, boilers etc.

By the use of the new electro-pneumatic brake which is just being inaugurated on some of the trains of the Pennsylvania Railroad, the starting and stopping of trains will be accomplished with more ease than heretofore. Especially with long trains it has been impossible to start a train without some shock to the passengers, but the object of the new system is to secure a rapid

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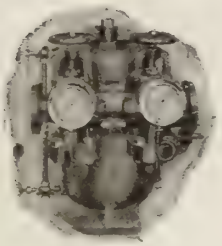

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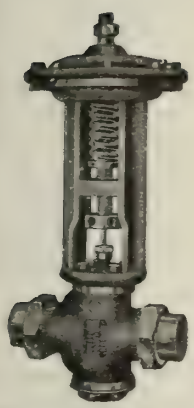

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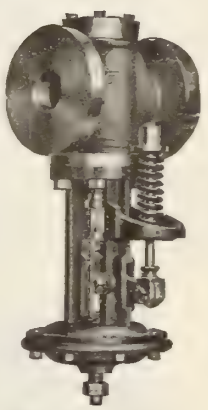

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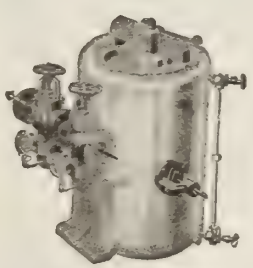

Reilly Feed Water Filter and Grease Extractor

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VALVES AND REGULATORS

TRIAL TRIPS.

Most of the ships owned by the well known Atlantic Fruit Co., of New York, have come from the shipyards of Messrs. Swan, Hunter & Wigham Richardson, Ltd., Wallsend-on-Tyne, and these builders have now completed another finely modelled fruit-carrying ship named St. Mary, for the same owners. The hull was constructed at Messrs. Swan, Hunter & Wigham Richardson's yard at Southwick-on-Wear and it was then brought to the River Tyne for the installation of engines and boilers at their Neptune Engine Works and for completion.

The St. Mary is a single-screw ship, built to Lloyd's highest class under the superintendence of Messrs. Esplen & Sons, Ltd., Liverpool, consulting naval architects and engineers, and their Mr. A. E. Ash has had special charge of the ship. The leading dimensions of the St. Mary are: 270 feet in length between perpendiculars, with an extreme breadth of 39 feet, and a depth of 25 feet to the shelter deck. The ship's crew is accommodated in the stern while the officers and engineers have their quarters amidships in the deckhouse where there are also arranged some spare cabins and the dining saloon. Above the last-named apartment and beneath the navigating bridge there are cabins for the captain and his chief officer. The holds of the ship are lined for the carriage of fruit and the double bottom has been constructed to carry either oil fuel or water ballast.

The boilers and the triple expansion engines of the St. Mary have been built at Messrs. Swan, Hunter & Wigham Richardson's Neptune Engine Works, Walker, Newcastle-on-Tyne. There are two boilers 16 feet in diameter working at a pressure of 190 pounds per square inch under forced draught. The propelling machinery consists of a single set of triple expansion four-crank engines balanced on the world-renowned Yarrow, Schlick & Tweedy system, designed to drive the ship at a service speed of twelve and a half knots. Oil fuel was used during the trial trip, which passed off without a hitch to the satisfaction of all concerned. The owners were represented by Mr. A. E. Ash, a director of Messrs. Esplen & Sons, Ltd., and Captain Y. A. Kranz, who is to command the ship.

The Miraflores has just completed a successful trial trip at sea off the mouth of the River Tyne. She is a finely modelled fruit-carrying ship built and engined by Swan, Hunter & Wigham Richardson, Ltd., Wallsend, for the Atlantic Fruit Co., of New York. Her leading dimensions are: 270 feet in length between perpendiculars, with an extreme breadth of 39 feet and a depth of 25 feet to the shelter deck.

The Miraflores is a sister ship to the St. Mary, also built by Swan, Hunter & Wigham Richardson, Ltd., for the same owners and which was successfully tried at sea a few days ago. The Miraflores has been built to Lloyd's highest class under the superintendence of Messrs. Esplen & Sons, Ltd., Liverpool, their director, Mr. A. E. Ash, having had special charge of her. The double bottom of the ship has been constructed to carry either oil fuel or water ballast. The captain and his officers and engineers are accommodated amidships, while the sailors and firemen have their quarters in the poop.

The engines and boilers have been built at Messrs. Swan, Hunter & Wigham Richardson's Neptune Engine Works, Walker, Newcastle-on-Tyne. The propelling machinery consists of a single set of four-crank triple expansion engines balanced on the Yarrow, Schlick & Tweedy system. During the trial trip oil fuel was used and the sea service speed of twelve and a half knots was easily attained. Steam is raised with two cylindrical boilers 16 feet in diameter and working at a pressure of 190 pounds per square inch under Howden's forced draught. The trial passed off without a hitch, to the satisfaction of all concerned. The owners were represented by Mr. A. E. Ash and Captain Davison, who is to command the ship.

Don't stop, you're almost out of the woods.
—Chapin in St. Louis "Star."

RECOMMENDED PRACTICE FOR ELECTRICAL INSTALLATIONS ON SHIPBOARD

The differences between the requirements of various Classification Societies and Insurance Companies in regard to electrical installations on shipboard and the lack of any accepted standard engineering practice for marine installations led the American Institute of Electrical Engineers in 1913 to appoint a committee on the use of electricity in marine work, now known as the Marine Committee. This committee besides arranging for papers to be read at the meetings of the Institute to increase the interest of electrical engineers in marine problems, also took up the preparation of the Standardization Rules which would represent good engineering practice, and which might be accepted by the Classification Societies. As a result, a set of rules was prepared covering two important divisions, namely: Fire Protection Requirements, and Marine Construction Requirements. The first part related primarily to dangers that might arise from fires, and the second part had to do purely

with the preservation, maintenance and operation of the electrical plant in its exposure to the conditions existing on shipboard.

These rules were adopted by the Committee of the American Bureau of Shipping and were published as Section 37 of the rules for building and classing vessels, issued by that Bureau.

This first edition of the rules did not cover the entire field of the use of electricity on shipboard and the committee was, therefore, continued in force, and a more nearly complete Set of Marine Rules has now been prepared. The committee has made a careful comparison of the rules issued by the American Bureau of Shipping, the National Board of Fire Underwriters, the Steam Boat Inspection Service of the U. S. Department of Commerce, Lloyd's Register of Shipping, the Institution of Electrical Engineers, Bureau Veritas, Germanischer Lloyd, and Verband Deutscher Elektrotechniker. With several of these associations, correspondence and personal conferences were carried on.

When the committee had nearly completed its work on the second set of Marine Rules, the Regulations for the Electrical Equipment of Ships, first edition, were issued by the Institution of Electrical Engineers in England. These rules have substantially the same scope as those prepared by the American Committee, and as there will be

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ENGINEERS PLEASE READ

Messrs. Guildford & Sons Ltd., May 26th, 1921.
Halifax, N. S.

Gentlemen:

Regarding your Tiger Brand Superheat Piston Packing which has been in use in the S. S. "Chaleur" for the last trip, I have to state that the Weirs Pump was packed April 2nd, 1921 and was in continuous use under a pressure of 185 lbs., until May 16th, 1921, a period of forty-four days. The packing was perfectly tight and gave complete satisfaction. I am sending you a ring, taken out of the gland after arrival in port and you will notice how small was the wear, that it is still soft and pliable and the asbestos core retains its lubricant.

I have no hesitation in saying that this packing is good for six months used under conditions as above.

I am,

Yours truly,
(Sgd.) W. J. Mitchell,
Chief Engineer S. S. "Chaleur"

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Messrs. Wm. C. Wilson & Co., Camden St., Toronto, Ont.

some occasion for comparing the engineering practices of the two countries, a slight rearrangement of material has been made to conform more nearly to the order of subjects as given in the English Rules, in order to facilitate comparison.

In the preparation of these rules, consideration has been given to the danger from fire, and to durability and reliability of the electrical apparatus itself, but no attempt has been made to divide the rules into separate sections of that character.

Certain mechanical signaling systems are included, as it is the custom of many shipyard electrical engineers to supervise the installation of mechanical signaling equipments as well as the electric plant.

The membership of the committee being drawn from a large variety of shipbuilding, manufacturing and engineering interests, including the U. S. Navy, it is thought that the rules, as prepared, represent the best practice for this class of work. During the war a large number of the newer shipyards were represented on the Marine Committee, which gave opportunity for advising them, through the committee meetings, concerning the best engineering practice as followed by the older yards.

To insure a careful consideration of these rules sub-committees were appointed to cover various branches of the work, and after each sub-committee had considered its own rules, they were submitted for discussion to the entire committee, after which they were referred to an editing committee of four members to arrange them in suitable form for publication. It is not to be expected that this edition of the rules contains everything that might be of value relating to electrical installations on shipboard, and it is expected that later editions will be prepared which will be more complete and will include electric propulsion.

In the meantime, any questions concerning rules, which appear to be of doubtful meaning, may be referred to the chairman of the Marine Committee of the American Institute of Electrical Engineers, 33 West 39th street, New York City, and the committee invites suggestions for improvements or amplifications of these rules.

No definite arrangements have yet been made for the approval of appar[illegible] and accessories, but it is expected that through the co-operation of the Underwriters' Laboratories, arrangements will be made later by which appliances and accessories used on shipboard may be inspected and approved.

In the absence of approved standards for merchant ships, appliances approved by the Navy Department will in gen[illegible] be satisfactory.

Bound copies of the rules may be obtained at $1.00 per copy from the address of the American Institute of Electrical Engineers, 33 West 39 h street, New York, N. Y.

TESTS ON PISTONS

According to comparative experiments conducted at the Charlottenburg Technical High School, pistons made of aluminum are somewhat superior to cast-iron pistons in several respects, the superiority expressed in percentages ranging from 10 up to 30 for the various factors. In the experiments the stroke, compression ratio and mixing ratio were varied, and the fuels tried were benzene and spontaneous ignition. The aluminum pistons did not give rise to any unpleasant pinking, and the most favorable compression ratio could be raised 20 per cent. higher than with cast-iron. The power was increased by 10 per cent., the fuel consumption decreased by 30 per cent., especially with short stroke. Combustion being more rapid with aluminum pistons, the exhaust gases were slightly less hot (by 8 per cent.) than with iron pistons; the heating of the cooling water was not influenced by the piston material. The pistons used had a diameter of 121 mm. (4¾ in.) and were given about 2 mm. clearance. Some of these advantages seem to be debateable.

FLEXIBLE SHAFT COUPLING

The Ajax Flexible Coupling Company of Westfield, N.Y., has placed on the market a new flexible coupling, simply constructed. Hardened steel bolts are fitted to the flanges, the heads of the bolts projecting alternately on either side and the body of the bolts entering oilless bronze bearings. The flexibility is obtained by means of compressed Para rubber surrounding the bronze bushings. There are no projecting parts from the body of the coupling and all parts are interchangeable. The coupling requires no lubrication and is said to operate under all conditions without noise.

COUNTERBORE AND SPOT-FACER

The Bickford-Switzer Company of Greenfield, Mass., are now marketing what is known as the "Cutwell" counterbore. The device has only two cutting lips placed diametrically opposite and cut helically with the axis of the body; this construction permits of easy sharpening. The tool may be secured in standard sizes or made to suit special conditions. It is especially adapted to production counterboring and spot facing.

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MOTOR SHIPBUILDING

The number of motor ships now on hand indicate the remarkable strides which have been made in motor shipbuilding in this country during the past few years. When it is remembered that until the end of the war comparatively little progress had been made in Great Britain in this new branch of shipbuilding, it is a record of which we may reasonably be proud that of the half million tons of motor shipping now under construction throughout the world more than half are being built in British yards. Moreover, shipbuilders in the United Kingdom have taken the lead in the construction of large vessels with internal-combustion engines of high power, and several are now in hand in which machinery of 6,400 h.p. will be installed, including one for the Ocean Steamship Company of Liverpool.

This new vessel, which will be built by the Caledon Shipbuilding and Engineering Company at Dundee, will have a displacement of 15,000 tons and a speed of approximately 13 knots. The machinery will be supplied by Burmeister and Wain and will comprise two engines of the same size and type as those fitted in the four 14,000 ton Glen Liners built by Harland and Wolff. Each engine develops 3,200 i.h.p. in eight cylinders, and the total daily fuel consumption of the vessel when fully laden, including the oil necessary for all the auxiliaries, will be under 20 tons. In accordance with the policy followed by the majority of owners of motor ships, practically all the auxiliary plant will be driven by means of electric motors, and for the provision of the current three 150kw. Diesel driven generators are to be installed in the engine room.

Among other recent orders for large motor ships are two 14,000-ton vessels for the Holland America Line, and a vessel of similar dimensions, but designed mainly for passenger carrying is being built to the order of a well-known British shipowning company. All these vessels are now on the stocks at Harland and Wolff's yards, and in each case twin screw machinery of 6,400 i.h.p. will be installed, built to the same design as the engines in the motor ship for the Ocean Steamship Company.—Engineering Supplement.

DIESEL ENGINE PROGRESS.

Some time ago we described in these columns the Cammell Laird Fullager Diesel engine, which is of the opposed piston two-cycle type, and is also notable for the fact that the pistons in adjacent cylinders are connected by diagonal rods. The top piston of one cylinder is thus connected to the bottom piston of the adjoining one, and two cylinders and four pistons form a unit.

The engine was first tried out in the electrically welded vessel "Fullagar," built by Messrs. Cammell Laird, and was built in the 500 B.H.P. size for this purpose. After some months running, during which it received a thorough trial, it was taken out of this ship and installed, together with a duplicate engine, in another vessel.

There is now being built a Cammell Laird Fullagar engine of 4000 B.H.P., which will be the largest unit yet built for marine work on the Diesel principle. This is a four-cylinder unit, and owing to the long stroke possible with this type of engine, the revolutions will only be 90 per minute, with a comparatively small cylinder diameter of 26 inches. The stroke of each piston is 42 inches. The comparison in weight and floor space is very much in favor of the two-cycle engine of the opposed piston type as against the four-cycle type of Diesel.

Trials recently made on the first 1000 B.H.P. unit built of this type gave a consumption per b.h.p. of only .39 lbs. fuel per hour.

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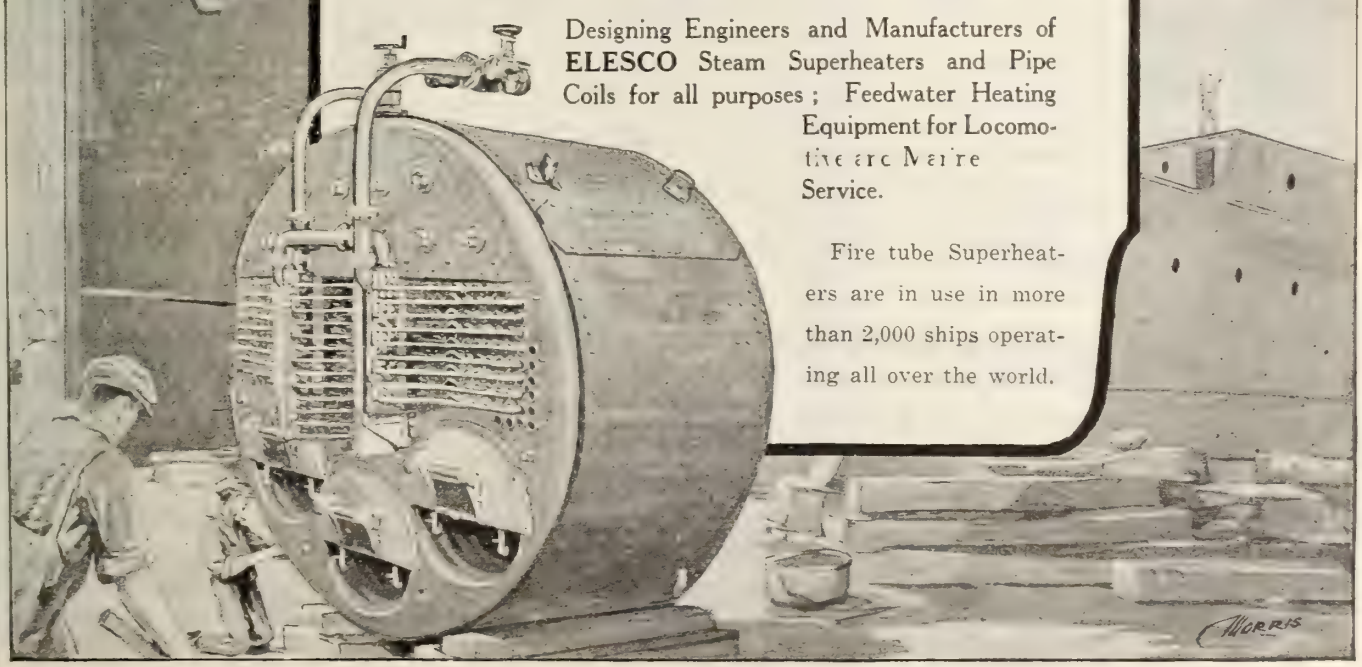

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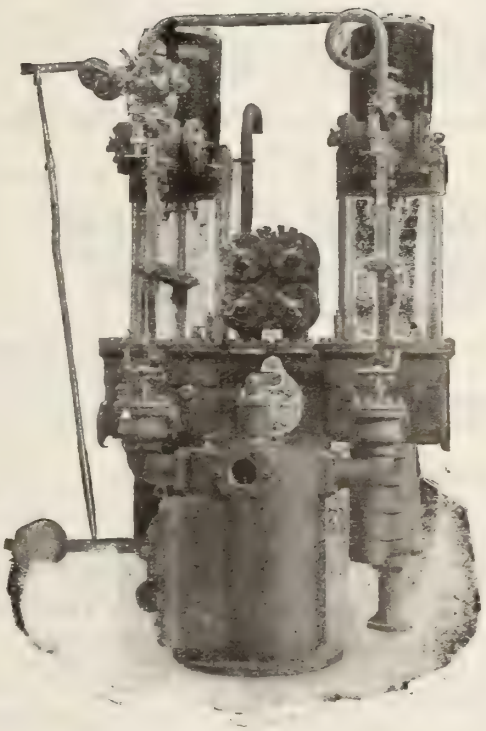

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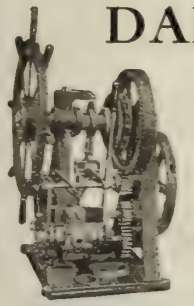

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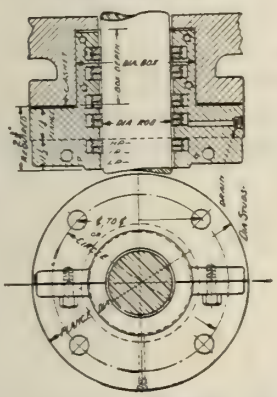

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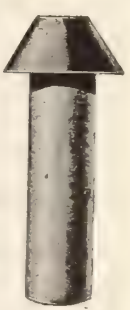

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R. C. Miller Oil & Supply Co.
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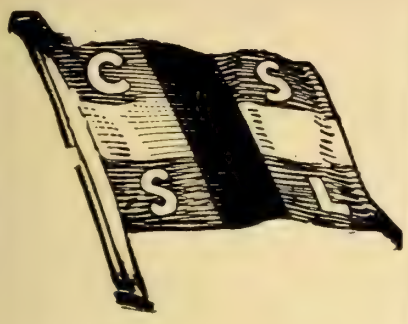

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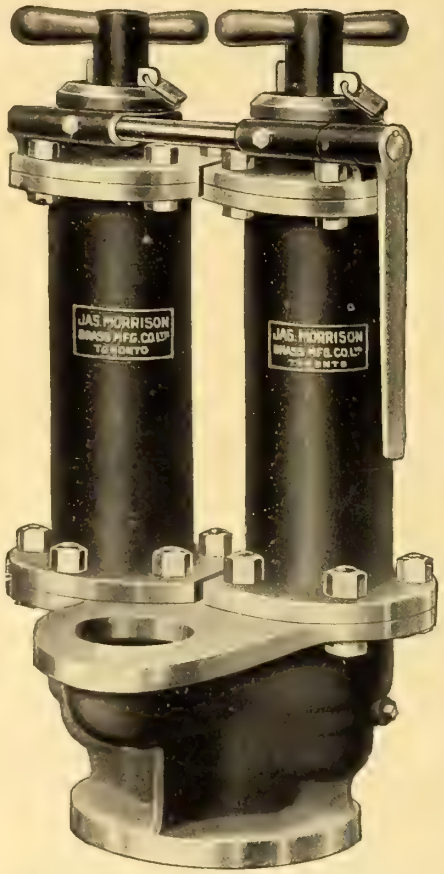

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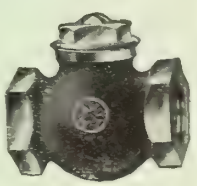

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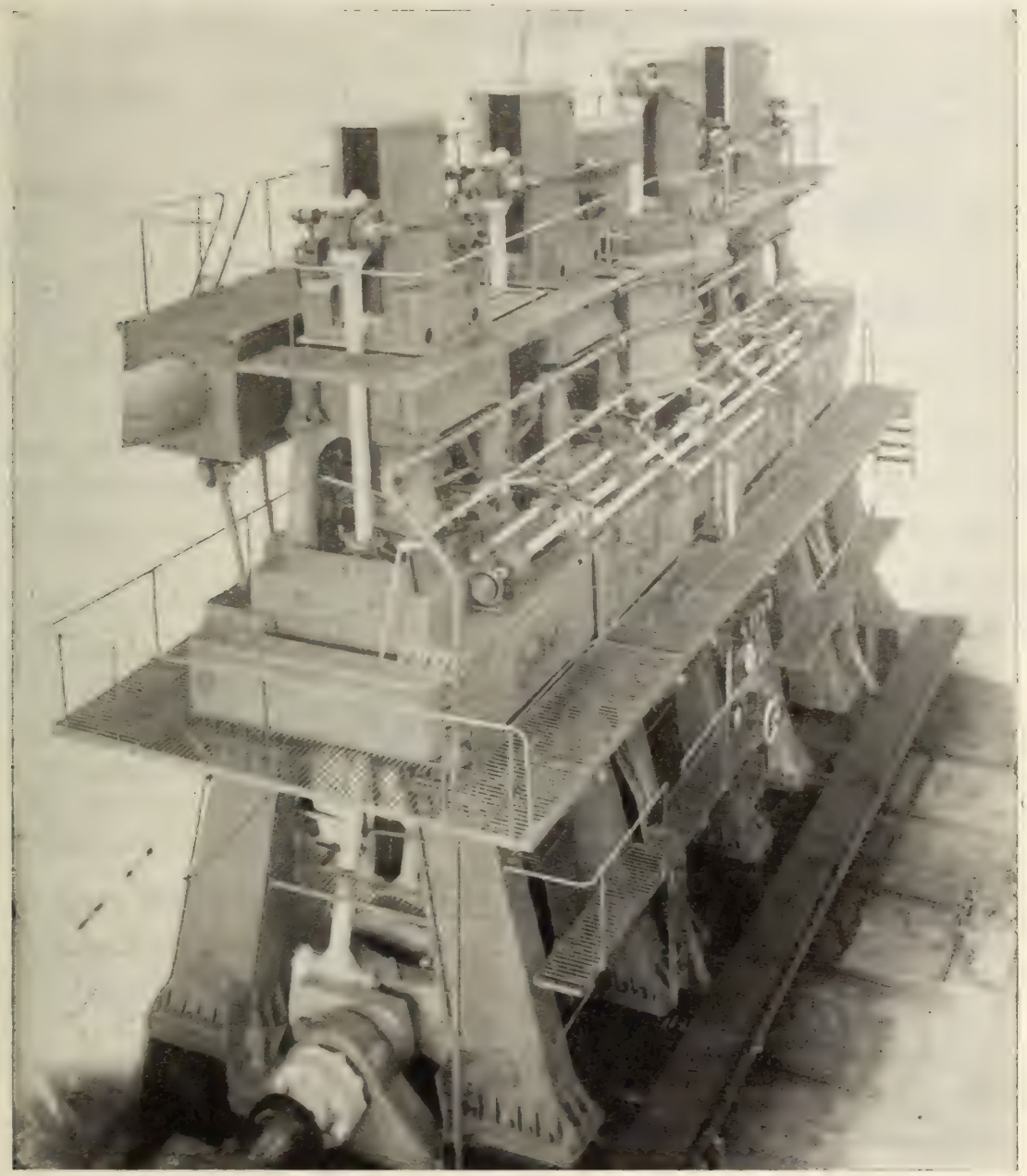

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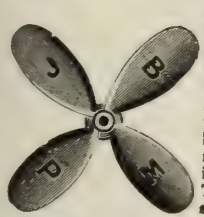

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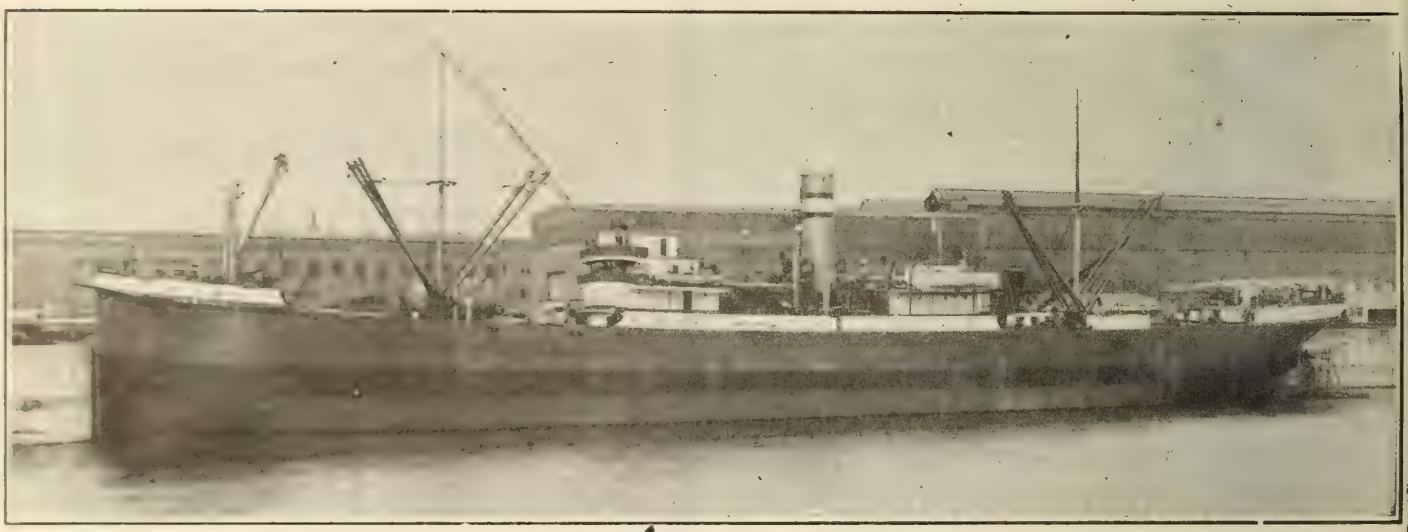

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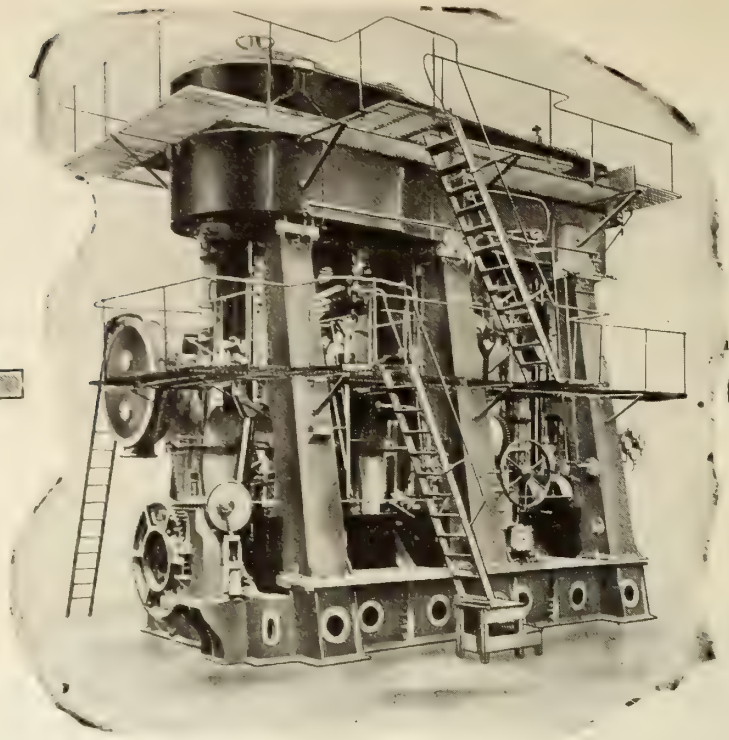

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A Guide to the Canadian Marine Certificate

In This, the Second Article of the Series, the Study of Vulgar Fractions is Continued, Including Multiplication and Division of Fractions. The Use of Signs in Formulae is Taken Up.

By T. H. FENNER

THE previous article, dealt with the method of addition and subtraction of fractions, and there still remains the question of division and multiplication. There is nothing very difficult about either of these, the chief thing to observe being care in the way that a problem is stated, and strict observance of the rules that will be given herein. In order to make the study as simple as possible, before taking up the question of multiplication and division, we shall show the method of reduction by cancellation.

Cancellation

Before attempting any operation on fractional numbers, it is always best to reduce them to the lowest terms and thus simplify the work. Supposing you have a term like 28/32. If the numerator and denominator can be divided equally by any number, the resulting fraction will be the same value as the original term. Thus, 28 and 32 can both be divided by 4 and the resulting fraction is 7/8, which is much more simple than 28/32. The same practice can be applied to any fraction, and with practice it becomes easy. Suppose we have:

$$\frac{39}{52}+\frac{45}{90}+\frac{16}{48}$$

Before finding the L.C.D. we see if the terms can be reduced. Take the first numerator. It can be divided by 3, but the denominator cannot. However, 3 goes into the numerator exactly 13 times, which shows that 13 will go into 39 just 3 times, and 13 will also go into 52 exactly 4 times. We have then instead of 39/52 the much handier fraction of ¾. The next one, 45/90, we see at once reduces to ½, while the last one will reduce to 1/3. The sum thus becomes:

$$\frac{3}{4}+\frac{1}{2}+\frac{1}{3}$$

The L.C.D. of which is seen to be 12. It is easy to see if a fraction can be cancelled. If the last figure of a term is 5, it can always be divided by 5 or a multiple of 5. Thus, 125/325 can be divided by 5, which gives 25/65, which can again be divided by 5, giving 5/13, which is the lowest term. Suppose the number is 84/156, then 12 will divide both terms evenly. When the divisor cannot be seen at once, try a smaller one, and then find another number to divide the resulting fraction. For instance, in the last term, divide first by 4, giving 21/39, and then by 3, which again gives 7/13. It is usually easier to divide by a small number first, and if it will go try multiples of that number mentally till the highest possible divisor is found.

Multiplication of Fractions.

The operation of multiplication will be taken up first, as division is merely multiplication reversed, as we will see later. Multiplication of fractions is carried on in exactly the same manner as ordinary multiplication, for as it is true that twice times one are two, so it is true that twice times one half are two halves, or three times two thirds are six thirds, etc. In multiplication of fractions, as we have two distinct parts, consisting of numerator and denominator, we simply multiply together all the numerators and all the denominators, the product of these being the number required. It will be seen that in this case we do not find the least common denominator as we do in addition. The reason is very easy to see. In addition we have a number of different parts, which must be added to one another to make a total. It is obviously impossible to add one third to one fifth without bringing them both to similar terms which we do by finding the L.C.D. In multiplication, however, we have a different statement. Taking the two same fractions one-third and one-fifth, the problem is to find one-fifth part of one-third part, or one-third part of one-fifth part. The multiplication sign x always is read "of" so that 1-5 x 1-3 reads one-fifth of one-third. Multiplying the numerators together 1 x 1 gives 1, and the denominators 5 x 3 gives 15, so the answer is 1-15. To prove that this is correct we may make use of the L.C.D. again, and bring both fractions to the same terms. Thus 1-5 will be 1-15 and 1-3 will be 5-15. Then it will be clear that 1-5 of 1-3 must be 1-15 which is found by multiplying together the numerators for the new numerator, and the denominators for the new denominator.

In multiplying when there are several terms it is much more simple to place all the numerators above a single line and all the denominators below it, with the signs between each one both above and below the line, instead of keeping each fraction separate. The illustration shows the method adopted.

$$\frac{1}{2}\times\frac{3}{16}\times\frac{7}{8}\times\frac{14}{32}\times\frac{28}{20}$$

$$\frac{1\times3\times7\times14\times28}{2\times16\times8\times32\times20}$$

After the problem is set down in the above manner, the next step is to see if it is possible to cancel any of the fractions, by dividing the numerators into the denominators or vice versa. If this cannot be done perhaps some of the individual fractions can be reduced by dividing both their numerator and denominator by the same number, as was shown before. Take each term separately. The first term cannot be reduced, neither can the second, or third. The fourth term can be divided by 2, and the fifth by 4, or we might divide the denominator or numerator is also divided. Alwas remember that a numerator or denominator cannot be reduced unless a corresponding denominator or numerator is also divided. This evens up the top and bottom. Dividing a numerator into a denominator or vice versa, is always correct, providing the divisor is cancelled as well as the dividend, but in reducing by outside divisors as we have just suggested, care must be taken to ensure that both a numerator and denominator are reduced at the same time. Let us illustrate this point.

$$\frac{1\times3\times7\times14\times28}{2\times16\times8\times32\times20}$$

$$\frac{1\times3\times\overset{7}{7}\times\overset{7}{14}\times28}{2\times16\times8\times\underset{16}{32}\times\underset{5}{20}}=\frac{1029}{20480}$$

$$\frac{1\times3\times7\times14\times\overset{7}{28}}{2\times16\times8\times32\times\underset{8}{20}}=\frac{2058}{40960}=\frac{1029}{20480}$$

$$\frac{1\times3\times\overset{7}{7}\times14\times28}{2\times16\times8\times32\times20}=\frac{4116}{81920}=\frac{1029}{20480}$$

First.—Cancelling the fourth term by 2 and the fifth by 4.

Second.—Cancelling the denominator of the fourth term and the numerator of fifth term by 4.

Third—By cross cancellation, and fourth cross cancellation, and cancelling one numerator and one denominator by 4.

The final result of the second sum is further cancelled by 2, and the third by 4.

Take a simpler case:—

$$\frac{3}{4}\times\frac{8}{6}\times\frac{12}{9}\times\frac{14}{16}\times\frac{18}{24}$$

$$\frac{3}{4}\times\frac{\cancel{8}}{\cancel{6}}\times\frac{\cancel{12}}{\cancel{9}}\times\frac{\cancel{14}}{\cancel{16}_{2}}\times\frac{\cancel{18}}{\cancel{24}_{3}}=\frac{3}{2}=1\frac{1}{2}$$

The second line shows how it would appear after cancelling.

There has not been a single multiplication operation in solving this problem. It has all been done by cancellation, and it is surprising how often this can be done in actual problems. It saves time and also makes for accuracy. For instance in a calculation frequently occurring in boiler work, we get an expression of this kind, which can be reduced like this.

$$\frac{6\times5\times22\times2\times2\times16}{8\times8\times28\times1\times5\times5}$$

$$\frac{\cancel{3}\times\cancel{5}\times\cancel{11}\times\cancel{2}\times\cancel{2}\times\cancel{2}\times\cancel{16}^{2}}{\cancel{8}\times\cancel{8}\times\cancel{28}\times1\times\cancel{5}\times\cancel{5}}=\frac{11}{14}$$

The rule to remember for multiplication of fractions is this: First reduce all fractions to their lowest term. Multiply all the numerators and all the denominators together, and reduce the resulting numerator and denominator to their lowest terms.

Division of Fractions.

The division of fractions is simply to a large extent a repetition of the multiplication of fractions. However there are some points to observe that are different. If we wish to find out what number represents a fraction of a whole number, we multiply the whole number by the fraction. For instance if we want to know the number representing ¾ of 2, we multiply 2 by ¾, thus

$$\frac{2\times3}{4}=\frac{2}{1}\times\frac{3}{4}$$

Now we really have divided 2 by 4 and multiplied the result by 3. But suppose we wish to find out how many times ¾ is contained in 2. We must divide ¾ into 2. To do this we must first find out how many quarters there are in two and divide that number by 3. Now we know there are four quarters in 1 and in 2 there are 4 by 2-8, and 8 divided by 3 gives 2 2-3. If we set this down in the ordinary way it would appear as

$$\frac{2}{1}\times\frac{4}{3}=\frac{2\times4}{3}$$

From this we derive the rule for the division of fractions, which is "Invert" the divisor and multiply. Taking an example:

Divide $\frac{7}{8}$ by $\frac{15}{16}$

$$\frac{7}{8}\div\frac{15}{16}=\frac{\frac{7}{8}}{\frac{15}{16}}$$

$$\frac{7}{8}\times\frac{16}{15}=\frac{7\times2}{15}=\frac{14}{15}$$

Another example:

Divide $\frac{2}{3}\times\frac{18}{12}$

$$\frac{2}{3}\times\frac{12}{18}=\frac{4}{9}$$

Now let us see an example where there are more than the two fractions containing the divisor and the dividend, in other words, a compound fraction. Take

$$\frac{14}{16}\times\frac{13}{12}\div\frac{7}{8}\times\frac{8}{10}$$

It could also be stated thus

$$\frac{\frac{14\times13}{16\times12}}{\frac{7}{8}\times\frac{8}{10}}$$

$$\frac{14\times13}{16\times12}\Big/\frac{7\times8}{8\times10}$$

They would all mean the same thing. Let us take the first statement:

$$\frac{14}{16}\times\frac{13}{12}\times\frac{8}{7}\times\frac{10}{8}$$

This becomes:

$$\frac{\cdots}{16}\times\frac{13}{12}\div\frac{7}{8}\times\frac{8}{10}$$

And by cancellation:

$$\frac{13}{6}\times\frac{5}{8}=\frac{65}{48}$$

In the second statement:

$$\frac{13}{\frac{16\times6}{1}}$$

and we can cancel out to begin with and the statement becomes

$$\frac{\times13}{\times12}$$

$$\times\frac{8}{10}$$

which worked out is:

$$\frac{13}{96}\times\frac{10}{1}=\frac{130}{96}=\frac{65}{48}$$

The third statement can be worked out as follows: ,

$$\frac{\cancel{14}^{7}\times13}{16\times\cancel{12}_{6}}\Big/\frac{7\times8}{8\times10}$$

$$\frac{\cancel{7}\times13\times\cancel{10}^{5}}{16\times\cancel{8}\times\cancel{7}}=\frac{65}{48}$$

These examples illustrate how the principle of cancellation can be used to simplify complex statements, and reduce the actual calculations to be made.

The Use of Signs

Before proceeding with some examples of complex fractions, it will be better for the student to have some exercise in the use of the different signs in use in the common formulae. The sequence of operations to be followed in simplifying a complex fraction is directly indicated by the signs, so that it is necessary that these be well understood.

The commonest signs are of course the plus and minus, which everyone is acquainted with. The plus sign before a number signifies that that number is a positive one, while the minus sign indicates a negative number. When several numbers are in an expression, containing both of these signs, it means that all the negative numbers must be added together, and all the positive numbers added together, and the sum of the negatve numbers added to the sum of the positive numbers. In other words, the algebraic sum of the numbers must be taken. The result may be either positive or negative, and this may be puzzling to the man with no knowledge of algebra. However, if he just casts his mind to a very familiar feature of our winter climate he will understand it easily. If he looks at the thermometer on his way to work he may find it reads 15 below zero, or as it is usually called—15 degrees. By eight o'clock it has risen to —10, and by nine o'clock it has reached 0. At ten o'clock it reads 5 above, or plus 5 and stays there till one o'clock.

Then it comes down 5 degrees every hour, till at five o'clock it reads 20 below or –20. Now the average temperature for the 11 hours will be found by adding the readings of every hour together and dividing by 11.

The sum will be as follows:

$$-15+(-10)+0+5+5+5+5+0+(-5)+(-10)+(-15)$$

Adding the numbers of different signs together we get:

$$+0+5+5+5+5+0=20$$

$$-15-10-5-10-15=-55$$

The algebraic sum of these will be:

$$\therefore 55+20=-35$$

And the average:

$$-35\div 11=-3\frac{2}{11}$$

or slightly over three degrees below zero.

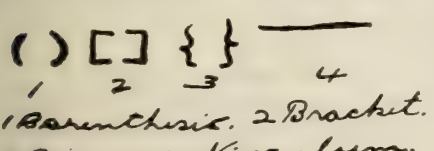
Now if we can imagine any other body or figure or scale with the same characteristics as the thermometer, that is a zero point, and a positive value above that point, and a negative value below it, there should be no trouble with plus or minus.

The multiplication sign is not always given by the conventional x. Sometimes this is omitted, and a small dot used, something like a decimal point, but placed at the bottom of the figures instead of the centre. This dot is as a rule used betwen figures. When letters are used and no sign at all placed between them it signifies multiplication as in the formula for H.P. plan which is read. When an expression is enclosed in a bracket with a figure before them, as 6(3x9) it means that the product of 3x9 is to be multiplied by 6. An expression such as 323.4.64 would read 323x4x64. This method is not in very general use, as it leads to confusion with the decimal point. The sign x is used, or no sign at all in the usual formula.

There are various ways of writing the division sign. The best known of course is the ÷ sign, which is the one we first become acquainted with in our school days. Then there is the straight line used between the two terms of a fraction which may be either horizontal or vertical, as

$$\frac{3}{4}$$

These four signs, that is plus, minus, multiplication and division may be called the cardinal signs. There are quite a number of others, which the student should be familiar with, as they are often met with in formula and are necessary to the correct solution of these expressions.



Probably the most important are the brackets, comprising, the bracket, the parenthesis, the brace and the vinculum. The generic term conveying all of them is "signs of aggregation," and the meaning conveyed by any of them is that the terms enclosed between them are to be simplified before any other operation is performed. The illustration shows the four kinds of brackets. Take an expression such as $A=\frac{1}{2}(h \times b)$ and substituting figures for letters say $A=\frac{1}{2}(3 \times 5)$. This means that the sum of 3 and 5, multiplied by ½, will give the value of A. Now take another case such as:

$$4+6(8\times4+5)-2=A$$

Here is where a very important rule is illustrated, in connection with the multiplication sign. Two numbers connected together with a multiplication sign, a bracket, vinculum, or brace, must be simplified before those connected by any other signs. In this case the solution step by step is, taking the inside of the brackets first, the product of 8 and 4, added to 5, multiplied by 6, plus 4–2. The work is as follows:

$$4+6(8\times4+5)-2=A$$

$$4+6(32+5)-2=A$$

$$4+6(37)-2=A$$

$$4+222-2=A$$

$$226-2=224$$

If the rule as to multiplying is not observed, the result will be altogether different. Suppose that in simplifying the terms in brackets we were to add 4 and 5 before multiplying by 8, see what we should get.

$$4+6(8\times9)-2=A$$

$$4+6\times72-2=A$$

$$4+432-2=A$$

$$436-2=434$$

If on the other hand we had added 4 and 6 before multiplying the expression in the bracket we should have

$$4+6\times37-2=A$$

$$10\times37-2=A$$

$$370-2=368$$

This illustrates the importance of the proper sequence in performing the operations.

HOW HE REMEMBERS THEM

One of the high officials of the Canadian Government Mercantile Marine—it is whispered that it is the President himself—has adopted a singular method of remembering the names given to the vessels of the fleet. Recently he was struck by the vocational quality attaching to the names given the vessels and he composed the following series of humorous—to employ a frequently misplaced adjective—paragraphs, which serve as aids to memory in connection with the long list of names of the ships operated in the interest and expansion of Canadian trade:

The 8100-8300 Class.

"A Pioneer, who had been a Planter and a Prospector, as well as a Traveller and Leader, employed a Highlander, who was an Inventor, and who had been previously a Miller to work with him as a Mariner, and, with himself as Commander, they set sail in a Freighter to seek their fortune. Being himself something of an Explorer and the other a Ranger, they quickly proved the Victor and Conqueror in the race for wealth. The old man was made a Seigneur, and as a Transporter, became a wealthy Exporter and Importer, and the old salt designed a Thresher, which he called the Challenger, which proved to be a Winner, and after having been a Skirmisher for many years, settled down to a life of ease and spinning yarns, and, being Scottish, believe me, he was some Spinner."

The 5100's

"An Aviator, who had been a Rancher, and who was employed as a flying Forester, dropped down on a Settler, who was something of a Trapper and Hunter, and asked where he could get a meal. 'Are you a Fisher?' he was asked. 'No, I'm a Raider,' he answered."

The 4400's

"The Otter is a great Navigator, is something of a Squatter, and, while not much of a Carrier or Runner, will always volunteer as a Voyageur."

The 3900's

"A Recruit from a Coaster became a Warrior by successfully serving as Gunner, Signaller and Observer. When discharged, he had a mind to become a Farmer. He worked like a Beaver for a season, but at heart was a Rover, and went West as a Harvester. Finally he drifted into the lumber camps and became a Logger."

The 3500's

"The Sailor is naturally an Adventurer. As a Pathfinder he has a harder task than the Engineer. He is frequently a Trader, seldom a Sower."

The 2800's

"The Miner is often a Sapper, seldom a Sealer."

The Hydro Electric Commission are contemplating the erection of a large modern office building at Hamilton, Ont.

Notes on the Management of Marine Diesels

The Author Compares the Four Cycle and Two Cycle From a Practical Standpoint—The Diesel Engine is Discussed in Detail, All Important Features Being Well Considered.

By MR. HOMER McCRIRRICK †

THE DIESEL Engine which has now established its position as a reliable and very efficient power unit suitable for ship propulsion does not seem to be getting the publicity from a practical point of view among Marine Engineers that it should.

The construction of large vessels which are to be propelled with Diesel Engines is increasing at a steady rate. Up till a few years ago developments with this type of engine were confined to land practice, and so the Marine Engineer is placed at rather a disadvantage as he has had very little opportunity of gaining experience in this line during his marine training. At present most of the engineers for the new motor vessels will be men whose past experience has all been with steam plant, they will be seeking out what practical information can be got as to how the Diesel Engine behaves, what troubles they are likely to encounter on long voyages, and the best means of remedying same before a serious breakdown occurs.

As the wading through books and technical journals is rather a heavy task when one has not too much time at his disposal, and as very little has been published regarding the practical side of Diesel work, a few notes from a Marine Engineer's point of view may be the means of opening up other sources of practical information. Many valuable papers have come before the Institute on the internal combustion engine, and much serviceable data can be got from a close study of same, but the present call seems to be from the more practical side. These notes which have been collected during the past few years both ashore and afloat are penned with the hope that they will initiate a discussion among the members and be the means of bringing the practical side of the heavy marine internal combustion engine to the fore among Marine Engineers in general.

The most successful and reliable type of Diesel Engines at present afloat are working on the four-stroke cycle. For long continuous running when the power units per cylinder are over 100 b. h. p., the use of blast air for injecting the fuel into the cylinder is well worth the extra cost of power and extra space required for fitting compressors for this purpose. The little extra labour necessary for the upkeep of these compressors repays itself in the much longer time exhaust valves, fuel valves, and pistons can remain in operation without being dismantled for overhauling. This saving of labour can be put down to a more complete burning of the fuel taking place in the cylinder, also I think it can be said that the extra number of heat units obtained from the fuel for useful work in the engine when blast air is used will compensate for the power required to drive the air compressor.

In two-stroke engines which exhaust through ports that are uncovered before the bottom dead centre, trouble seems to have been experienced with the water jacket and liner joint near these ports, also the cracking of the liners caused by the unequal expansion and rather awkward construction in way of the ports. Against this we have no exhaust valve troubles, but an exhaust valve is much easier renewed than the water jacket and liner joint. Pistons in the two-stroke engines seem to have given more trouble than the pistons in four-stroke engines owning to overheating and cracking, as they have twice the amount of heat to dispose of in a given time. Piston trouble seems to be now receiving marked attention from the metallurgical side, and this, combined with the various reliable piston cooling systems now in operation, should help matters greatly, also with careful attention by the ship's engineers to the fuel pump adjustments, the Diesel piston should not require any more overhauling than the high pressure steam engine piston.

When a piston becomes badly cracked the cylinder gases will pass through to the water side and displace the cooling water from the piston, this can be detected by only hot gases passing from the piston cooling return pipes, and it is advisable to shut the fuel and blast air off from that cylinder and have the piston removed at the first opportunity.

Cylinder Heads or Covers.

In the four-stroke engines, cylinder heads or covers are rather intricate castings owing to the number of valves which have to be accommodated in them, namely, fuel, air starting, exhaust and inlet. Many points have to be considered in the design of the cover, its large depth to allow of sufficient area for the air inlet and exhaust gases passing to and from the cylinder. The circulating water must have a clear passage over as much bottom area as possible. Provision has to be made for a passage through the water space to carry the starting air to the starting valve which will be at a pressure of 20 to 25 atmospheres. The air passage which has to carry this high pressure will most likely be eliminated in the future, and the air starting valve designed to take air from a pipe coupled up to it on the outside of the cover.

The under side of the cover when the engine is working will have to withstand a pressure of 40 atmospheres when the average temperature during the power stroke is about 2,200 degrees Fah., so any bad distribution of metal is liable to cause distortion, and cracks will probably result. Care should be taken that no large quantity of sand or mud is allowed to find a way into the covers and deposit on the bottom. Hand doors are provided for the examination of the inner surfaces, asd should be opened occasionally, and any deposit removed. Deposits are also likely to be found at the bottom of the liner water jackets, this is not so serious provided it does not choke up the water passage. In small engines of less than 100 b. h. p. per cylinder it will be found advisable after three or four years operation to have the cylinder liners drawn, in most cases the small ports round the top of the water jacket will have become partly choked and will therefore be liable to cause over-heating to the covers through insufficient circulation.

Many cracked cylinder covers are at present doing duty on engines running with full load; if much manoeuvring has to be done these covers become a source of danger, and whenever a stop is called for any length of time it is always advisable to shut down the circulating water pressure from the engine and so minimise the risk of water finding its way into the cylinder in case the covers have time to cool down and perhaps the cracks open. These cracks usually extend from the fuel valve across to the inlet and exhaust valves, round this area is where the water passages are greatly contracted and a most likely place for mud to deposit.

The joint between the cover and liner is usually a ground face to face joint with a little oil and graphite painted on the surface. When these joints show signs of leakage it is advisable to have them seen to at once, as the passage of hot gasses between the two surfaces will soon burn the spigot. Grinding rings are sometimes supplied for facing up these joints or else copper joint rings can be inserted between the faces. Cases have been known where the burning has become so deep that a piece of copper had to be dovetailed and pinned into the spigot before a tight joint could be obtained.

Fuel Injection Valves.

One of the characteristic parts of a Diesel Engine is the fuel valve, the whole success of burning the fuel properly lies in the design and adjustment of this

† Transactions of the Institute of Marine Engineers.

valve. With regular overhauls and the use of a good packing material, very little trouble will be experienced, the gland packing box which has usually a depth of four spindle diameters seems to answer its purpose well when packed with good lamp cotton plaited to size and well soaked in oil and graphite. There are one or two kinds of semi-metallic packing on the market, which also answer their purpose well but what must be guarded against, if possible, is wear taking place on the spindle where it passes through the packing, this wear, which is often found to start in the form of pitting, may be caused by some chemical in the oil. After it has been going on for some time slight scores or grooves form along the rod in way of the packing, this I think can be put down to a fine grit findng its way into the packing from the oil, and though the spindles are case hardened, it seems to have effect on them. It is always advisable when overhauling fuel valves to try and smooth over any roughness on the spindles with a very fine emery stone.

The most destructive trouble with the fuel valve is a small leak starting on the valve face, this may be caused by a particle of hard grit adhering to the face and allowing burning to take place thereon. A fuel valve with a slight leak caused by the valve face being pitted or burned, or the spindle partially seizing in the gland, can very often be detected by a slight blow back of air through the inlet valve muffler during the time the inlet valve is open.

If the leak attains any size, dangerously high pressures will be formed in the cylinder causing the escape valves to lift. Pre-ignitions are liable to occur with a leaky valve and they can be detected by a dull heavy knock. A fuel valve leakage caused either by a burned valve face or a seizure of the valve spindle, is quite capable of bringing the engine to a stop through loss of blast air.

Seizure of valve spindles mostly occur when starting up a cold engine or when manoeuvring after a long run. Sometimes this sticking of a valve spindle can be overcome if sufficient blast air can be obtained for the short time of manoeuvring the engines, but it is not recommended that this be done unless in cases of urgent necessity, as there is always a risk of dangerous explosions occurring in a cylinder with a leaky valve.

The pulverizing and spraying of the fuel is effected by means of a number of drilled or slotted washers and a special grooved cone piece. Generally speaking, these do not receive very much attention apart from cleaning when the valve is opened up for overhauling. At the present time most motor ships are on regular runs, and so able to obtain the most suitable fuel oil, these conditions are not going to continue for ever with the increasing number of motor ships. More practical information is therefore wanted for the adjusting of pulverisers which will enable the engineers to judge different grades of fuel oil and so meet any valve trouble before it becomes serious.

Another rather important item in the fuel valve is the small non-return valve fitted in the valve casting to prevent blast air finding its way down to the fuel pump. These valves do not require very much attention apart from an occasional grind on to their seats with very fine powder, care must be taken when the small valve cage is replaced in the fuel valve casting that the copper ring joint is well bedded all round. As a further precaution against blast air passing the non-return valve and finding its way to the fuel pump another valve of the same type is inserted in the fuel pipe line. When only one non-return valve was fitted to each fuel valve, a leakage of air past same, caused by either the valve sticking open or a piece of grit adhering to its face, would be liable to cause a stoppage of the engine if the air passes in sufficient quantity to displace the oil from the pump.

Exhaust Valves

Valve faces in exhaust valves are manufactured from a special mixture of cast iron suitable to withstand gases at a temperature of 700 degrees Fahr. passing over them. Valves spindles are made of steel and means are provided in large valves to renew the cast iron faces on them by unscrewing a nut and bedding on a new C. I. face.

In exhaust valve cages the spindle guide is usually water-cooled as shown in Fig. 1. After these valve cages have been in use for some time corrosion has started at the core plugs and allowed water to find its way into the exhaust piping. If the engine has been standing for any length of time with this leakage going on, a considerable amount of water may find its way into a cylinder through an open exhaust valve. The trouble is then to find where the water has come from, as in large engines there is always the possibility of a leakage starting in the water-cooled exhaust box, or cylinder covers may be cracked and leaking.

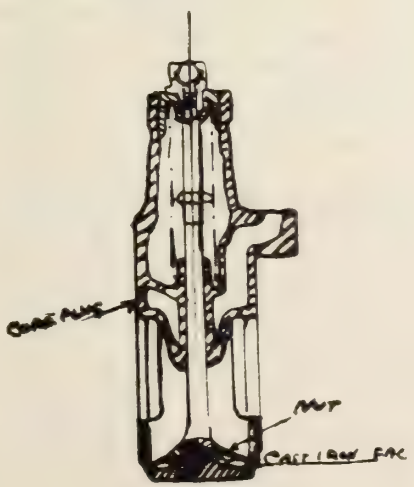


FIG. 1.

Broken levers have been caused by springs being fitted into valves and not having sufficient compression clearance; whenever a new spring is fitted or an old one packed up with washers always make sure that the valve has the required travel.

Inlet Valves

These valves are practically of the same construction as exhaust valves, except for the omission of the removable C. I. valve fare and the water-cooled spindle guide. Air strainers or silencers are fitted on the inlet induction pipes, these must be frequently cleaned to allow of a sufficient supply of air reaching the cylinder during the time the inlet valve is open and so permit the complete combustion of the fuel. If this condition is not fulfilled a vacuum is likely to be created in the cylinder and the slight back pressure of the exhaust gases will tend to jump the exhaust valves off their seats and allow burnt gases to pass back into the cylinder, this will result in bad combustion, loss of power and a smokey exhaust.

Air Starting Valves

These valves are only in operation when starting up the engine either ahead or astern; immediately the engine is put on fuel the starting valves are automatically cut out of action. When engines are slow in picking up on fuel some engineers are inclined to interfere with this automatic arrangement and allow fuel to be injected into the cylinder when the starting valves are also in operation. This practice is not to be recommended as when the burning of a fuel charge takes place the pressure will be above the starting air pressure, and if any oil should have found its way into the starting air system there might be the danger of an explosion in same. There is also the danger of burnt gases carbonising the starting valve spindles.

The starting air enters the valve by a passage through the cover, the pressure tending to open the valve is balanced by the large diameter of the spindle above the opening; in large engines this part of the spindle is fitted with small ramsbottom rings to ensure tightness. Starting valves should receive the same careful attention as fuel valves, as in all likelihood a starting valve sticking open a little will prevent a start of the engine until it is freed. A slight leakage past the face of a starting valve while under way can sometimes be overcome by a restart of the engine with air, or by turning the valve round to a different position on its seat. If this will not stop the leakage it is advisable to change the valve at once as the small hole or groove will only enlarge with the passing of the burning gases. As the valves are common to the one air pipe, these gases, if allowed to pass, will only tend to carbonise up the starting valves spindles. The cage for holding the starting valve in the cover has usually a metal to metal face joint at the bottom, and provision is made for a thin soft joint at the top. The space be-

tween these two joints is where the air is led to the valve; care should be taken that both joints are properly bedded, as a leakage at the bottom would admit air to the cylinder when not required, or the cylinder gases will pass back to the air starting system when the engine is under way. A badly made joint at the top would cause a loss of starting air, or with the engine working on load, any fuel oil leaking from the fuel valve spindle gland may find its way into the starting air system and might be the cause of an explosion the next time the starting valves came into operation.

Valve Timing

In engines working on the four-stroke cycle the following table gives approximately the timing of valves in cylinder with the I. H. P. in each ranging between 100 and 400 and with a piston speed of 700 to 800 feet per minute:—

Fuel Valve opens 6 degrees before T. D. C. and closes 34 degrees after T. D. C.

Starting Valves opens 10 degrees after T. D. C. and closes 140 degrees after Top Dead Centre.

Exhaust Valve opens 40 degrees before B. D. C. and closes 10 degrees ofter T. D. C.

Inlet Valve opens 20 degrees before T. D. C. and closes 15 degrees after B. D. C.

The same settings are arranged for ahead and astern.

Great care should be taken when adjusting valve lever or push rod on clearance cams. After any large overhaul, or once a year, the fuel valve settings should be tried for correctness. In small engines where the cam shaft is driven by bevel or skew gearing from the crank shaft, and every part of the vertical shaft, coupling, and gearing is enclosed, any slackness of keys is apt to remain unnoticed. If a key has been an easy fit sideways when the engine left the works, it is bound to work itself further slack in a year or so, with the result that the cam shaft setting will be retarded. A key slackness of a little over 1/16th of an inch that came before the writer's notice, was found to alter the valve timing by six degrees, when this engine first showed signs of sluggish starting it was put down to change of temperature condition in the engine room. After this passed over and there was no change in the starting up of the engine the trouble was looked for in the valves, fuel pump and cylinder compression clearances: as these were all found in order, a further search had to be made which resulted in a slack key being found in the muff coupling of the vertical shaft, which drove the cam shaft.

Indicator diagrams play a most important part in tuning up the Diesel Engine, they provide the quickest means of ascertaining what adjusting may be required to obtain the best combustion of the fuel and also seeing that the load is distributed equally in each cylinder.

Fig. 2 is the approximate form of a theoretical diagram. Compression starts from A when the air will be at a temperature of about 120 degrees Fahr., it then continues until point B when the temperature will reach 970 degrees Fahr. and the pressure will be about 500 lbs. per square inch. The injection of fuel oil now starts and is injected between B and

FIG. 2.

C; combustion should proceed at a rate which will permit the increase of volume, due to the motion of the piston, to be so balanced by the increase of temperature, due to the combustion of the fuel, that the pressure will remain constant until the whole of the fuel has been injected when the temperature at C will be about 2200 degrees Fahr., burning of the fuel still continues, it is stated, until the piston has travelled about one-fifth of the stroke, when expansion will then continue until the exhaust valves open at D and the gases will be released at a temperature of about 750 degrees Fahr. To come as near this ideal condition as possible in practice, all valves in the cover must be kept in good condition, rings must be free in piston, and the compression clearance should be adjusted regularly, as the wear on top and bottom ends is taken up.

When the engine has been running for a little and is properly warmed up, compression cards should be taken from each cylinder with the fuel and blast air shut off, everything being in order they will indicate a pressure of 500 lbs. per square inch. We now come to the combustion of the fuel, which should be sprayed into the cylinder in particles of such a size as will expose sufficient surface to allow of combustion taking place within the proper time, and not of a very violent nature. If combustion takes place too quickly, the blast pressure should be reduced, as the greater the excess of blast pressure above that of compression, the more quickly will the quantity of oil measured out per impulse of the fuel pump into the valve casing be blown into the cylinder. If the fuel oil is of such a highly inflammable nature that a reduction of the blast pressure will not regulate the period of combustion sufficiently, then it may be advisable to alter the sprayer plates in the fuel valve and so prevent the fuel oil from being broken up too finely. On the other hand, care must be exercised when any adjustment is made of the sprayer plates, that the combustion of the fuel will not be delayed to such an extent that burning will take place during the latter part of the expansion stroke.

The effects of after-burning have the same effect as incomplete combustion and cause excessive cylinder temperatures, which tend to burn the film walls. This shortage of lubrication will cause increased wear on the cylinder walls, danger of piston seizure and piston rings sticking. In large engines with open cylinder ends, shortage of cylinder lubrication can usually be detected by a slight grunting noise from the affected piston. If caught in time, the supply of oil from the lubricator can be increased for half-an-hour or so, but if the piston has become much overheated and sparks are passing down from same it is advisable to cut off the fuel oil from that cylinder, slow down the engine, and attempt to spray cylinder oil up inside the liner with a syringe.

The combustion part of the cycle takes place when the piston is moving slowest, with the usual type of indicator gear supplied, the record of pressure change in the cylinder at this time is put into very small space. Should further investigation be required as to what is taking place during combustion, it can be obtained with a draw card, this can be taken by disconnecting the indicator cord and at the instant that fuel starts to be injected into the cylinder, the indicator pencil should be held to the card and the drum quickly moved round by hand.

In figure No. 3 a full power diagram is shown, the line above the top of the diagram is the usual type of draw cord obtained when combustion is proceeding in the required way. At point A the injection of fuel is starting, a slight rise of pressure is indicated here and continues for a time until the fuel valve closes and the burning of fuel ceases and expansion starts.

Figure No. 4 is a card from a cylinder having rather early ignition of fuel, the height of the card has increased and the burning of the fuel appears to take place quicker. This can usually be overcome by increasing the clearance between the push rod and the fuel cam

FIG. 3.

a little, should a slight adjustment of the clearance not be sufficient then the position of the fuel cam piece will have to be put back a few degrees.

Figure No. 5 is a card from a cylinder having very early ignition, if the valve setting is correct this may be caused by a leaky valve or else the spindle is seizing to such an extent that the force of the spring cannot close the

valve. A valve in this state will not continue to operate long, if it is not convenient to stop the engine and change the valve, it is advisable to shut the fuel and blast air off, as dangerous compression pressures may be generated in the cylinder.

Figure No. 6 is a card from a cylinder having very late ignition. In cold weather, cylinders with the ignition taking place so late will be difficult to start firing when under way or manoeuvring, and the combustion of the fuel will not be perfect, resulting in a smoky exhaust. A card of this type may also be obtained from a cylinder using heavy oil which has not been pulverised sufficiently, and also through using too low a blast pressure if the engine is on load.

FIG. 4.

There is also the possibility that sufficient air is not finding its way into the cylinder to allow of proper combustion. If there is any doubt about this, a card taken with a weak spring in the indicator will indicate by the distance of the exhaust or inlet above or below the atmospheric line whether there is too great a resistance for the gases to leave the cylinder freely, or the air to enter freely.

At light loads there will be more than the required quantity of air in the cylinder, and with the extra air coming in as blast along with such a small quantity of oil, the ignition is bound to be retarded owing to the cooling effect of the large proportion of blast air over the fuel.

Particular attention should be given to the fuel pump adjustments, once these are set and a card taken from each cylinder showing the required mean pressure, which is generally about 6.5 Kg./C.M2 or 95 lbs./sq. inch, the fuel pumps should not be individually interfered with to increase the quantity of oil supplied to any one cylinder which may show a falling off in power during continuous running. The trouble will in all probability be other than the fuel pump adjustments, and may be such as inefficient supply of air to the cylinder caused by either a partially choked inlet or exhaust, or a little grit interfering with the operation of the fuel pump valves. The first cause may be removed when overhauling at a port of call, the second may remove itself any time during the ordinary running of the engine. If the amount of fuel delivered per stroke of a fuel pump has been increased over the ordinary settings of the other fuel pumps, and the loss of power has been removed from the cylinder by causes as stated above,this cylinder will now start to develop much more than the required power and a cracked piston may result before the increase of power is noticed.

Air Compressors.

Air compressors are of the two stage trunk piston type in small engines and the three stage type in large engines. In the past, most of the trouble with compressors was due to valves breaking; a large amount of attention has been given lately to the design of these valves and also the quality of material used in their construction. Valve trouble has been reduced to a minimum, and compressors can be run for months without any overhaul, provided the lubrication of them is carefully watched by the engineers in charge. Excessive lubrication seems to be responsible for most compressor worries at the present time, the surplus oil gets carbonised and adheres to the valves, with the result that through time they become choked up.

The air strainers or silencers on the L. P. stage must be kept free from dirt and oil, so as to prevent the slits in them becoming closed up and not allowing sufficient air to pass into the compressor. If the passage of air is in any way restricted a vacuum will be formed during the suction stroke and in a two-stage compressor of the trunk piston type there will be a tendency for vapour and oil to pass from the crank case to the top of the compressor piston. Scraper rings are fitted in the lower end of the piston to prevent this, but unless these rings are kept a good fit the lubricating oil seems to find its way past them, and will eventually deposit at the valves, or in the air passages, and become a source of danger.

FIG. 5.

The safety valves on the water side of the intercoolers should receive periodical attention to prevent their sticking fast, in case a leaky tube or coil tends to raise the pressure inside the water casing to a dangerous height.

The air passages which are part of the compressor casing containing the suction and discharge valves at each stage, are also fitted with safety valves, which should receive occasional attention, as there is a danger of explosions taking place in these passages, through excessive lubrication and the heat of compression in the air.

A small air leakage from a compressor coil or intercooler may be detected when the engine is running, by the pumping action of the circulating water when it leaves the ship's side. Or by leaving the cooling water circulating round the compressor or intercoolers, when the engine is stopped any leakage will show up by a continual drip of water from the drain on the air side of the coolers.

A quantity of lubricating oil seems to find its way into the L. P. and I. P. coolers with the compressed air, and adheres to the tubes, reducing their cooling effect, these tubes are so arranged that they can be bodily withdrawn from the cooler casing for cleaning purposes, and under ordinary running conditions it will be advisable to clean the tubes about every two years.

The greatest wear in compressor cylinders takes place at the top end of the H. P. stage, and after three or four years running it will be found advisable to have them bored out parallel and a new top fitted to the piston.

Lubrication

The general practice now with large engines is to supply oil under pressure to all the main bearing surfaces, small bearings, such as cam shaft and levers, are oiled by hand.

The crank cases are entirely closed except for breathing holes situated near the top. In the large 3,000 I. H. P. installations, about 20 tons of lubricating oil is carried in a small part of the cellular double bottom, this oil which is circulated round the engine bearings falls to the bottom of the crank case and is then drained to the double bottom tank, where it has the benefit of the cooling surface of the ship's skin.

The lower ends of the cylinders in large engines are usually separated from the crank case by a distance piece, fitted with a tray through which the piston rod passes. This space between the lower end of the cylinder and the top of crank case is open to the engine room, and means are provided to drain away all the surplus oil which gathers here, this waste oil should on no account be collected and used for lubricating purposes, being mainly composed of oil that has had its substance burned away, and containing particles of carbon and ash that have been carried down from the piston top, it will thus act as a fine grinding paste on any bearing surfaces that it comes in contact with.

Careful attention should be given to all connections and joints in the water-cooled guides and piston cooling gear, so as to avoid any large mixing of water with the lubricating oil. After any large overhaul of moving parts, any waste, wood, or other refuse should be carefully removed from every corner of the crank case, or they will only become a source of trouble when the engine gets

FIG. 6.

under way. In cold weather lubricating oil that has had a large percentage of salt water mixed with it, will tend to thicken up, and trouble will most likely be experienced with the pumps and also in getting the oil to flow freely back to the D. B. tanks. This may cause serious delays and a lot of unnecessary work and worry on the part of the engineers so the importance of keeping the lubricating oil free from all foreign matter cannot be too strongly impressed on all the engine room staff.

The consumption of lubricating oil with 3,000 I. H. P. installations under full running conditions, will average about 1/14th of a ton per day of 24 hours, any loss can be put down to evaporation and small leakages. To keep the oil in as good condition as possible, I think it is advisable once a year to allow it to settle for four or five days and permit any foreign substance or water to fall to the bottom of the tank. The suction pipe should then be raised about eight inches above the bottom of the tank, and the oil pumped back into the crank case, the tank can then be thoroughly cleared out and fresh oil added to make up the deficit.

Engine and compressor pistons are lubricated by small force-feed oilers, which are filled up every watch by the attendant; in view of the importance of compressors being supplied with the correct oil, it will be found expedient in large motor ships to paint compressor oil tanks, oil cans, and lubricants, a distinct colour, and so avoid any errors in oiling when perhaps the vessel has started on a voyage, with a new engine room crew.

Lubrication troubles have been caused in auxiliary engines by the oil adhering to the walls of oil passages in the crank shaft and eventually closing them up. When any serious oil thickening has been encountered, a little time spent blowing steam or compressed air through the crank shaft oil passages, may save many hours work at some future time, and also the cost of replacing overheated bearings.

With care and good judgment on the part of the ship's engineers in the adjustments of the motors, a well kept storeroom and properly indented spare part list, there is no reason why the Diesel Engine cannot be made as reliable as steam plant. Repair bills on the old ships seem to be on the high side at present, but with the increasing improvements in design and choosing of suitable material for the various parts which show deterioration, the bills will be greatly reduced in the future.

MARINE BOILER EXPLOSION

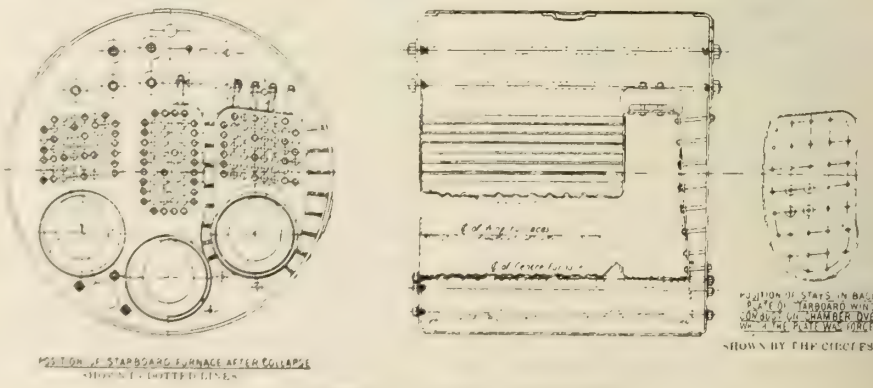
It is unusual for a boiler to be seriously damaged by the causes which brought about the explosion in one of the main boilers of the "Baltriger," and the circumstances emphasise that those who are in charge ought to be not only well trained in their duties, but capable of exerting thoughtful attention to all the circumstances transpiring in connection with these duties and, arriving at the wisest conclusion, provide for the safest course of action.

The boiler on which the explosion took place was a single-ended circular of the usual type with three furnaces and oil fired, and was five years old. The Baltriger on arrival in London was berthed and had the port boiler blown down for cleaning, the starboard one being meantime used for steam in port. As there was no donkey boiler—when cleaned the port boiler was filled by means of a pump till the water showed 6in. in the glass; shortly afterwards the centre furnace was set away and the general service pump started to circulate the water valve and the auxiliary feed check valve. in the boiler through the blow down After a hour and a quarter, the pump was stopped and the wing furnaces were soon afterwards set away. About an hour subsequent to this the donkey-man went to pump up the starboard boiler with the general service pump, with the suction open to the port engine-room tank. As the pump did not draw, he found, on sounding it, that the tank was empty, so he changed the suction to the starboard tank. As the pump still did not work satisfactorily, the third engineer's attention was called, when he found that the donkey-man had opened the main check valve on the working boilers, he told him that the pump delivery cock was set for the auxiliary feed line of pipe. The chief engineer then had the auxiliary feed check valve on the port boiler—left open after the circulating of the water had been stopped— closed, and told the donkey-man to see that the blow down valve on the port boiler and the cock on the ship's side were closed; the latter which is common to both boilers was found to be not properly closed, as indicated by the key which was on the cock. It was then closed and the key disengaged and hung on its appointed place. The general service pump was at this time drawing from the starboard engine-room tank and the chief engineer assumed that it had been delivering into the port boiler, the auxiliary feed-check valve being found open instead of to the starboard boiler, yet the time it was open on the port one did not admit of the assumption that the water had reached to a level above the top of the gauge glass, hence was not showing in the glass. On this, however, it was decided to pump some of the water from the port boiler into the starboard boiler, which showed about one quarter glass. After thus pumping for about 20 minutes the water was still not showing in the port boiler glass, and shortly afterwards, the oil burner in the centre furnace in the port boiler was not working satisfactorily, and the chief engineer was engaged in examining it when, with the steam gauge indicating 65 lbs. pressure, flame and smoke burst from the starboard furnace, and the oil supply was then shut off, to see what had happened. On examination it was found that the back of the combustion chamber had been drawn over four of the studs towards the crown of the furnace, which had also collapsed, and, as an illustration of the elastic nature of the steel, was bent into semi-circles from the crown to the mid wings till they touched about the centre line of the furnace tube; the crown being brought over for a short distance and formed into a loop. The collapse occurred about equidistant from back to front of the furnace. The wing furnaces and combustion chambers were but slightly distorted.

It appeared from the official enquiry and investigation that the boiler had been short of water and the assumption that it was full and above the glass on the gauge inaccurate, and evidently the discharge had been set for the sanitary service in place of the feed pipe line to the boiler. This case is one which is worthy of study by all engineers.

To the Canadian National Railways and to the Province of Ontario, belongs the honor of operating the first Edison storage battery car in Canada. The line is being run from Belleville to Trenton, with an hourly service. The first trip was made on May 16, and the officials of the railroad are highly pleased with the results. The estimate is that the cost of operation for the car is about 35 cents a mile. Steam cars are said to cost $1 a mile.

EXPLOSION FROM A MAIN BOILER ON BOARD THE S. S. BALTRIGER



SHOWING DAMAGE TO BOILER.

MOTOR BOAT TRADE IN ENGLAND

H.M. Trade Commissioner in Toronto, on information received through the head office in London, England, has issued the following statement.

The motor boat industry has not been free from the difficulties which have occurred to all engineering industries during and since the war. In January, which is usually taken as the most acute period of depression, it was thought that there would be a revival of trade towards the end of the spring. These hopes have not been wholly justified, although a slight improvement has been noticed. It would appear that a misleading impression was created in the industry by the fact that many enquiries were made earlier in the year than usual in order that enquirers might ascertain the conditions of the market, and to enable them to decide when the price level would be suitable for the normal continuance of business. The labour difficulties and other economic causes have apparently caused a business revival to be deferred for another month or two.

Coming to the period immediately before the writing of these notes it would, however, appear that there has been considerable activity, and it is reported by manufacturers that a marked improvement has occurred over the previous six months. It is not possible at present to say whether this is a genuine revival of trade or only another spasmodic outburst of enquiry, but it is certain that with the fall in prices to liquidate stocks, marine motors are being sold at extremely reasonable figures, even compared with the pre-war cost of such products. It is considered probable that the cost of fuel for such motors must undergo a considerable reduction in price and this will, if hopes are confirmed, tend to raise the market to a condition it has not been in for a very long time.

Another factor which is influencing the choice of petrol or oil-fired motors for marine purposes is the continued stoppage of the coal producing industry through labour troubles, and the consequent delays and losses incurred by coal-fired vessels. Many persons seem to be convinced that the price of coal renders it a very unprofitable fuel for marine propulsion, and it is more than ever apparent that the owners of large fleets of small vessels will turn as soon as possible to some form of fuel which promises continuous working regardless of the troubles referred to above.

A large number of overseas countries appear to be in pressing want of motor boats and motors for use in locally built boats. Amongst those which have recently been making enquiries in this country are Yugo-Salvia, Mesopotamia, and Brazil. Some of the orders known to have been placed are on a fair scale and it is realized that the marine motor industry in this country must largely exist by catering for export trade. On the other hand, the exchange difficulties and lack of credit facilities make trading with many countries extremely difficult, where prior to the war a good volume of business could have been obtained, and the British manufacturer in this, as in other industries, is in the unfortunate position of seeing possible markets for his goods go to other countries owing to exchange difficulties for which there would appear to be no immediate solution.

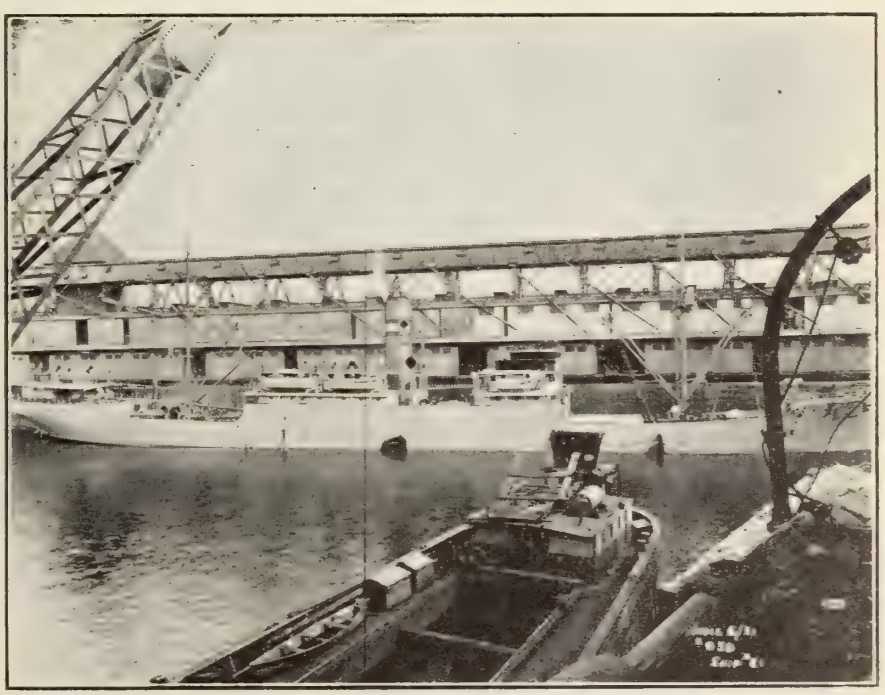
A NEW TUG

The handsome new tug Otis Wack, built at Parrsboro by J. R. Huntley for the Gypsum Packet Co., and which for several weeks past has been at the New Burrell-Johnson Iron Co.'s docks receiving her machinery, is now about completed. The engines and machinery are all set up and a few days ago the fires were started in her furnaces. Carpenters are yet, however, still at their part of the finish work, while the painters are also aboard and are following the former very closely. This splendid tug, when all complete, and ready for delivery to her owners will, without an an exception, excel in construction and equipment any vessel that has heretofore left this port. The planning of the Otis Wack is all that can be desired for the safety, convenience and comfort of her officers and crew, and in that respect she has been admired by many who know whereof they speak.

All of the officers' accommodations, excepting the captain's, are in the house on the main deck. They are elaborately finished and very sanitarily fitted with large airy rooms on the starboard side for the first officer and chief engineer, while on the port is a large room fitted for the second officer and junior engineer. Midships in this house is an excellent galley beautifully finished, in highly polished oak, while the fittings are of the latest sanitary pattern, and most conveniently placed for the use of the steward and his assistants. On the upper deck is the pilot house interiorally finished in Douglas fir, while the captain's room aft and immediately adjoining, is done out in oak. The pilot house is fitted with steam steering gear, telegraphs, etc., and is a model of up-to-date equipment. On the top of the house is an auxiliary steering apparatus to be used when docking, or at any other time the captain may wish a clear, unobstructive view of his manoeuvrings. The crew's quarters are under the main deck forward where is found ample accommodation for eight men.

The engine room is decidely replete with all that can be found in a modern ocean-going tug of the size of the Otis Wack, and particularly noticeable is the spaciousness of this apartment affording ample room for the engineers to perform their duties with every comfort. The engines, measurng 14x22x36, with a 24 inch stroke, capable of developing 650 horse power, are of the very largest type put out by the New Burrell Johnson Iron Co., and are conceded by all who have seen them, to be an unusually fine equipment. Steam is supplied a large boiler measuring 13ft. 6ins. x 10ft. 6ins. with a working pressure of 180 pounds.

The tug is to be used in towing gypsum plaster barges from Windsor and other upper Bay of Fundy ports to New York, and in consequence large bunker and water supply capacity is necessary. Too meet these requirements, bunker space has been provided for over 100 tons of coal, and tanks of over 6,000 gallons capacity have also been installed. It is expected the Otis Wack will be taken out on a trial run within a day or so, and shortly after will leave for Windsor where an electric lighting plant will be added to the completeness of this handsome new steamer.



THE CANADIAN VICKERS BUILT "TOPALSFJORD"

Not to be outdone by its rival Japanese shipping concern, the Toyo Kisen Kaisha nor by the Canadian Pacific Ocean Services, the Nippon Yusen Kaisha is reported to be placing an order with a Glasgow shipyard for the construction of a 15,000-ton freight and passenger liner to be operated in the trans-Pacific service. It is stated that all the materials required for the vessel's construction have been assembled at the Clyde and that she will be completed by the end of next year. The fact that the Canadian Pacific Ocean Services have augmented their service by the acquisition of the former German liner Kronprinz Frederic Wilhelm, now known as the Empress of China and that the Toyo Kisen Kaisha operating a fleet of steamships between Japanese ports and San Francisco has purchased the Cap Finisterre, re-named the Taiyo Maru, has spurred the Nippon Yusen Kaisha to go one better, and the new vessel that is said to have been ordered will be 1,000 tons bigger than the Taiyo Maru, which was originally offered to the N. Y. K. by the Japanese Government but rejected due to doubt as to her successful operation. Experience has dispelled all these doubts, however, and it is said that the former German liner is drawing much of the better class trade from the northern to the southern route.

Since depression struck the Japanese shipping market very few charters have been negotiated by Japanese companies, although chartering was freely done during the years of big trading during the war and immediately afterwards. Figures just released show that at the end of the last business term the Nippon

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Yusen Kaisha was operatng 103 vessels, totalling 674,000 tons deadweight, in their possession, and only 16 chartered vessels, of 57,797 tons. Since then the company has increased its ships by two, but has reduced its chartered vessels by [illegible]. Similar reductions have been made by the other companies.

* * *

H. F. Alexander was re-elected president and A. F. Haines was re-elected first vice-president and general manager of the Pacific Steamship Company when the company held its annual meeting in Portland. Me. The company, capitalized at $8,000,000, is incorporated under the laws of Maine, although its headquarters are in Seattle and its operations are centred on the Pacific. Stanley Dollar was re-elected second vice-president and A. M. Dollar treasurer.

* * *

The Pacific Steamship Company is operating its own fleet in the coastwise routes, a fleet of Shipping Board passenger liners and freighters in the Seattle-Oriental routes and a fleet of Shipping Board cargo carriers between Portland. Ore., and the Far East. The company is also Pacific Coast general agent for the North Atlantic and Western Steamship Company, of Boston.

* * *

The Osaka Shoshen Kaisha has reached the conclusion that for cargo carrying it cannot do better than adopt the same design for steamships as that followed by the Holt (Blue Funnel) Line and with that end in view has closed orders for the construction of two ships of about 10,000 tons almost exact replicas of typical Holt liners in England. The vessels will probably be operated between Japan and the United Kingdom. They will have the peculiar twin masts fore and aft and practically the same freight handling gear as used on the Blue Funnel ships will be installed. The vessels are to be delivered at the end of the year.

* * *

Negotiations are now in progress for the chartering of the S. F. Tolmie, first of the three wooden barquentines to be laid down by the Cholberg Shipyards, Victoria, for the Victoria Shipowners, Ltd. The Hastings Sawmills, Vancouver, have had options on the vessel for lumber shipments, but the question of insurance has hindered completion of the charter. Now that the Federal Government has taken over the vessels, chartering will be facilitated.

* * *

Coastwise shipping between California and British Columbia ports has been stimulated considerably as a result of the entry of the Canadian Government Mercantile Marine vessels into that service. One of the first accomplishments of the Canadian vessels was the obtaining of contracts for carrying pulp and paper from the British Columbia mills to San Francisco. This is one of the biggest trade commodities handled in this route, and to fulfil its obligations the Canadian Government steamers are operating on a ten-day schedule. Beginning June 17, the Admiral Line inaugurated a weekly service between British Columbia and California. Mr. B. C. Keeley, coast manager of the C. G. M. M., recently returned from San Francisco, where he completed arrangements for the use of the Holt Line (Blue Funnel) facilities.

* * *

The new steamer being built for the Canadian Pacific coast service to take the place of the ill-fated Princess Sophia, wrecked in 1918 in Alaska waters, will bear the name of Princess Louise. The vessel is being built at the Wallace Shipyards, Vancouver, and will soon be ready to take to water. The first C. P. R steamer to bear a name with the "Princess" title was the original Princess Louise, the first steamer operated on this coast by the C. P. R. and which is now being used as a barge, although in her day one of the finest steamers in local waters. She was a side-wheeler and built in New York by John English & Sons, in 1869. Prior to her acquisition by the C. P. R. she was known as the Olympian.

* * *

A lawsuit started in Vancouver regarding wages of crews engaged by steamships of the Canadian Government Mercantile Marine may have important results. The two men who have instituted the action shipped at Montreal for a period not exceeding twelve months, to be paid off in the Dominion of Canada. They left their ship the Canadian Carrier, when she arrived in British Columbia and were arrested. They were to be tried, but this was abandoned in order not to delay the sailing of the Carrier. The men claim that as Vancouver is in Canada they were entitled to leave there and that they are accordingly entitled to wages. The Sailor's and Firemen's Union have taken up their case.

* * *

That the Canadian Government steamships are cutting rates in their California service to such extent that private companies are unable to successfully compete against them at a reasonable profit in operation, is the basis of a complaint being heard a good deal here from shipping men. It is held that the purpose of the Canadian Government was to build up new trade routes with its mercantile marine and not to break into established business and drive out private interests. It is probable that the matter will be aired before long in the House of Commons at Ottawa, as it is evident that

operation of the Canadian Government steamships at rates now being quoted must result in heavy losses.

* * *

The Hudson's Bay Company's Arctic trading ship Lady Kindersley, recently completed by the B. C. Marine yards, left for the North June 30, carrying launches, scows and canoes for the company's trading posts on the Mackenzie River. The voyage of the Lady Kindersley, which is commanded by Captain Foellmur, will not be completed until late in the Fall. The vessel will go through Behring Straits and touch at points on the Siberian coast and Herschel Islands.

* * *

Capt. M. D. Harbord has been elected president of the Victoria Shipowners, Ltd., succeeding Clarence Hoard, who resigned. David Leeming is vice-president. Members of the board include General R. P. Clark, H. C. Hanson, A. C. Liggertwood, R. Angus, P. J. Riddell and P. H. Borradaile.

* * *

The Pacific Steamship Company and Struthers & Dizon have not rejoined the Westbound Conference, but expect to come in under a new reorganization scheme being considered now. The conference originally embraced all trans-Pacific lines except the Blue Funnel Line, Canadian Robert Dollar Company and The Canadian Government Mercantile Marine.

* * *

Depression in Japanese shipping has resulted in closing the Osaka Shipbuilding Company's yards, according to word just received from Japan. These constitute one of the largest yards in Japan. Twelve steamships are now under construction at Osaka, but builders are becoming more and more reluctant to accept orders due to the fall of price.

* * *

The American steamship Wenatchee, of the Pacific Steamship Company fleet, the largest American vessel on the North Pacific, is again in trouble, and engine-room disorders put her out of commission while cruising through the Inland Sea of Southern Japan. The Wenatchee left for the Far East with great ceremony. She carried Major-General Leonard Wood and other distinguished passengers.

* * *

Radical reductions in freight rates between British Columbia and Puget Sound ports and Australia and New Zealand have been agreed upon by the Canadian Government Mercantile Marine, operating out of Victoria and Vancouver the General Steamship Corporation, of Seattle and the Canadian-Australian Royal Mail Line, of Vancouver. The Oceanic Steamship Company, which runs a fleet out of San Francisco, is also a party to the new agreement.

* * *

The tariff on canned salmon has been reduced from $25 to $18 a ton; general merchandise from $25 to $20 a ton; box shooks from $15 to $10 a ton; portable houses, from $18 to $15; wall board from $18 to $15. The lumber rate, which was recently cut to $20 a thousand feet, will remain as it is. The new rate on salmon will go into effect August 1, when the new pack will be ready for shipment. The new tariffs are effective from all Pacific Coasts ports to Auckland and Wellington, N. Z., and to Sydney and Melbourne, Australia.

* * *

Unable to agree with some of the shipping interests of the northern territory, the San Francisco companies represented at the Westbound Freight conference, which has been meeting in Seattle, have withdrawn and will form a separate organization of their own in the California port. There is said to be no danger of a rate war, however, as a result of the splitting up of the old conference into three separate bodies, centred respectively at Seattle, San Francisco and Portland, Ore. Summarizing the growth of the disagreement a Seattle man said: "The California members of the conference got it in their heads that they were too big to work with Seattle and Portland and disbanded their sub-committee."

* * *

The Canadian Government has taken over the barquentines being built at the Cholberg Shipyards. Victoria, for the Victoria Shipowners, Ltd., and will finance their construction and probably complete the arrangements for their operation. Reports that the vessels would be made a part of the Canadian Government Mercantile Marine have been in circulation, but so far are without confirmation. Financial difficulties in which the Victoria Shipowners became involved interfered with the Cholberg programme, and government investigators are now attempting to straighten out the company's affairs. It was shown that the building of the barquentine Simon F. Tolmie cost $94,000 over the estimate of $250,000. Work on the Tolmie and the other two vessels now on the stocks has been held up since January. It is improbable that the fourth barquentine specified in the original contract will be built. The Government is having a complete inventory made, and is calling for tenders for the completion of the hulls. The Tolmie was launched some time ago and is now awaiting only the last stages of outfitting. Inquiries have already been made with a view to chartering the Tolmie.

* * *

Five of the big cribs to be used in connection with the construction of the landing wharf at the Skinner's Cove drydock, Esquimalt, will be built by Yarrows, Ltd. These cribs will be built on specially constructed ways at the Yarrow shipyards and will then be towed to the point of submersion off Skinner's Cove, where preliminary work is being carried on in connection with the Dominion Government's $5,000,000 drydock. Each of the cribs will be 100 feet long, 40 feet broad and 35 feet high. Construction of the cribs forms the basis of one of the sub-contracts let by the main contractors, Peter Lyall & Sons.

* * *

Advices received here indicate that the Canadian Pacific Ocean Services Liner, Empress of China, formerly the German steamship Prinz Friedrich Wilhelm, will arrive here shortly to become a part of the C. P. O. S. trans-Pacific fleet. It is expected that the Empress of China will make the passage by way of the Suez Canal and Hongkong. The Empress of Canada, now completing at the Fairfield Company yards at Glasgow, will soon be ready to leave for the Pacific. Her departure has been delayed by the joiners' strike on the Clyde.

* * *

Capt. S. Robinson, formerly master of the Empress of Russia, has left for the British Isles to take command of the Empress of Canada. Capt. Lovegrove, R. N. R., D. S. O., will take charge of the Empress of Japan, while Capt. W. Dixon Hopcroft, R. N. R., has taken Capt. Robinson's place on the Russia. Capt. A. J. Hailey is commander of the other big C. P. O. S. Liner, Empress of Russia.

* * *

The Pacific Steamship Company is seriously considering the purchase of the Empress of Japan to replace the steamship Governor, which was recently sunk off Port Townsend, Washington, in the coastwise trade between California and Puget sound and British Columbia ports. Vice-president A. F. Haines of the Pacific Steamship Company, made a preliminary inspection of the Empress of Japan while she was tied up in Vancouver recently. The C. P. O. S. is asking about $450,000 for the liner, but it is understood that the American company is hesitant about buying due to the high cost that would be necessitated in converting the steerage accommodation into first-class quarters such as are required for the coastwise tourist traffic.

* * *

According to R. R. Neild, formerly of the Victoria Machinery Depot in Victoria and now representative in British Columbia for John Inglis & Company, good progress is being made at Prince Rupert on the steel freighters being built there for the Dominion Government. The boilers have been installed on the steamship Canadian Scottish and a start has been made on the installation of the engines. It is expected that the Steamship will be able to undergo her trials in six weeks and by that time her sister ship, the Canadian Thrasher, will be able to take the water. The launching of the latter vessel will take place almost simultaneously with the running of the speed trials of the Canadian Scottish.

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The Government Programme

There are only ten vessels of the Canadian Government programme left to be delivered by their builders, and most of these have been already launched so that it is only a matter of a very few weeks until the programme is cleared off the books of the various yards. It has been an ambitious effort, and has given the country a fleet of sixty-three modern cargo carriers, at a pretty expensive cost. The inception of the programme was hailed with joy, and we heard many optimistic statements of Canada's future as a shipbuilding country, while yards sprang up almost overnight. The dream is over now, and most of the shipbuilding yards which came into being with a flourish of trumpets have passed quietly out of sight and memory, except perhaps that of their creditors. The vessels acquired by the Government have not as yet earned any interest on the capital invested in them, and the likelihood of their doing so is doubtful in the immediate future. However, they have done as well as any other vessels during the time of depression, and if their capital cost had been lower, would have had a chance of showing a real profit, instead of a political one. The best thing that could be done with them now is to sell them to private owners, making a proviso that their names be retained, so that wherever they went their Canadian birth would be evident, even if they were registered at a non-Canadian port. What difference there was between their sale price and cost of construction would have to be written off as a loss, which it might well be. It is better to have one writing off and be finished with it, than to go on year after year footing the bill for the sake of saying we own a fleet of ships.

And the Mountain Labored

At last the world is favored with the news that the U.S. government has appointed a new personnel to the famous U.S. Shipping Board. After the multitudinous investigating, editorial writing in the U.S. press, and solemn promises made to the nation by politicians seeking election, it would seem that the new board would have been composed of practical shipping men. Such is far from being the fact, even such an impractical man as our old acquaintance Admiral Benson being included in the board, although not as chairman this time.

A Pacific Coast shipping journal describes the new board in detail, and accepting their description as correct, we must confess that the aggregation does not look like one to solve the difficulties which beset that mercantile marine which was destined, according to the late chairman of the board, to practically wipe out that of every other nation. The new chairman, A. D. Lasker, is the head of a large advertising agency, and a prominent Republican. He is stated to be inexperienced in shipping, but an expert organizer and executive.

Admiral Benson, with whom we are all acquainted by reason of his ability to get in the limelight, is described as a Democrat, former chairman of the Board which he still adorns, and a naval officer of large experience. George E. Chamberlin, of Portland, Oregon, is a Democrat, has been Governor of Oregon, and twice a U.S. senator, and has always been regarded as a safe friend of the American mercantile marine. Meyer Lissner, Republican politician and publisher. T. B. O'Connor, President of the Longshoremen's Union. Edwin C. Plummer, Republican and admiralty-lawyer. Frederick I. Thompson, Democrat and newspaper publisher.

It will be apparent at once that there is not a man included among the above, who could really be described as an expert at ship management. The usual plan of picking men according to their political usefulness seems to have been followed out. Of course, it would no doubt be difficult to find men in the United States who combine the practical shipping knowledge and experience with a willingness to serve on the board. The whole history of that organisation has been one of unfulfilled promises and enormous waste of money, and it is doubtful if men who are not in politics would wish to be mixed up with an organisation that is bound to be pretty much at the mercy of the politicians.

The new board would probably have had a better chance if Admiral Benson had been left off it, as he seems to have the faculty of stirring up international ill feeling almost every time he makes a statement. The new board finds itself with an enormous fleet on its hands, a large portion of which is utterly useless, that is the wooden portion, while the rest of it cannot be operated except at a loss. Private firms show no disposition to take the vessels off the Board's hands, and it will require the utmost skill and knowledge of shipping conditions to pull the fleet out of the present position without further enormous loss to the American taxpayer. On the face of it, the newly appointed Board does not seem to possess that skill or knowledge, and it looks as though quite a few more millions of Uncle Sam's dollars will be sunk into his new mercantile marine. Mercantile marines and railways are pretty expensive toys for any country to play with, and we are likely to have some further unpleasant experiences of our own before we are through with our experiments in those directions.

SOME little time ago a great many scare headings were appearing in the U.S. press, anent the operations of some mysterious pirates, and a large number of missing ships. As the amount of knowledge concerning the sea and ships is not very great in the broad domains of the U.S., it is to be expected that a large number of people read these accounts with interest and like Oliver Twist, asked for more. Enquiry by Lloyd's elicited the fact that some of these mysteriously missing ships were not missing at all, being in fact snugly in harbour. Others so far from being missing, had not had time to complete the passage they were on when reported missing, and moreover, had been heard from within reasonable time. Unfortunately, there were two or three vessels actually missing, but their disappearance was amply accounted for by prevailing bad weather, which had caused their foundering. Of course, the enterprising reporter has to get a story or make one, but in this particular field of his endeavour, he should take every precaution to get facts. The report of a missing ship can bring so much pain to those on shore, and keep them in grievous suspense until the story is confirmed or exploded, that every care should be taken against awaking these emotions unnecessarily. It would fill the front page just as well to start a story about the sea serpent, or the shipping board, in either of which cases the public would be amused and no harm done to anyone in particular.

News of the Shipping World

CONSIDERABLE indignation still continues to be manifested in the British press in connection with the case of Cammell Laird & Co. and the water tube boiler. In previous issues of Marine Engineering we have mentioned the facts of this case. Considerable difficulty has been experienced with certain types of water tube boiler drum, owing to its flattened construction, and some bad failures had taken place. This was so serious that it interfered with the speed of some of our war vessels, enabling the German ships to escape on several occasions when a chase was on. Through the ingenuity of the management and staff of Messrs. Cammell Laird this difficulty was overcome, and a means was found of keeping the Admiralty straight tube, but making the drum circular instead of flattened. This of course removed the weakness, and enabled vessels whose pressure had been cut down to once more carry on at their full rating. As the war was at its height, the Admiralty requested the engineering firm to delay any action towards securing a patent or any particular reward until after the war was finished, meanwhile giving the Admiralty free use of it. With true patriotism the firm complied, and then when the war was all over, claimed their patent. The Admiralty, sheltering itself behind a committee, refused to grant a patent, alleging that the alteration in design was obvious to anybody, that commonsense was not invention, and some other equally unfair and foolish decisions. This is an outstanding case, but there are many others where the Admiralty has taken advantage of the patriotism of shipping and industrial firms during the war, and then did their best to avoid any recompense when the danger was past. Anybody dealing with a Government department should have very clear and unbreakable agreements, as the average Government official seems to be without a conscience.

THE retirement is announced of Mr. James T. Milton, M.I.C.E., the chief engineer since 1890 of Lloyd's Register, a period extending over thirty years. Mr. Milton has seen some interesting changes in the engineering profession since he assumed office, among them being the adoption of the quadruple expansion engine, the invention of the marine steam engine, the reducing gear as applied to the turbine, and the development of the Diesel engine. The period of his office also covers the development of high tension steel, and its use for boilers, the introduction of the water tube boiler, and the use of oil fuel for steam raising. The committee, in granting Mr. Milton's request, which was made on account of advancing years, have made arrangements by which Mr. Milton will give them the benefit of his advice if they should at any time wish to consult him. Mr. Milton is widely recognised by the profession as a marine engineer and was honored by Durham University with the honorary degree of D.Sc. Mr. H. Ruck Keene, M.I.C.E., assistant to Mr. Milton, has been appointed to succeed him.

IN connection with the adoption of oil fuel, it has been noted that vessels that were designed for a certain speed with coal have been making much better speeds with oil fuel. This of course is attributed to the fact that there is practically no fluctuation of pressure with the oil burning boiler, such as occurs with coal fired boilers at cleaning periods. An instance is given in the "Aquitania," which vessel although designed for several knots less than the "Mauretania," has equalled the latter's speed on the measured mile, since being fitted with oil burning installation. When burning coal she made only her designed speed. The C.P.O.S. steamer, "Empress of Canada" attained a speed of 25 knots on the measured mile, although not designed for any such speed. This of course means that these vessels can attain their designed speed for a much less consumption of oil fuel than that of coal, and also that a vessel designed as an intermediate ship, can on occasion be converted into an express ship by the expenditure of a little extra fuel.

NELSON'S old flagship the "Victory" is beginning to show signs of her age, and the result of a survey held upon her recently at her moorings in Portsmouth Harbor is that she must have extensive repairs, involving a heavy expense, or she will gradually disintegrate. It must be remembered that the Victory was laid down at about the time of Nelson's birth, so that she might reasonably be expected to be showing signs of wear. The suggestion has been made by the Liverpool "Journal of Commerce" that she be put in to one of the small graving docks round the coast, which has lost its usefulness, and be coated with a protecting cement for a certain distance up from her keel, and the dock then filled in with earth. This method would preserve her indefinitely. The other alternative is to rebuild her, which does not meet with much favor. We agree with the Journal of Commerce that no effort should be spared to keep the gallant old line of battle ship with us as a source of inspiration to the rising generation. She represents so much to the British people that she should be kept in the land of the living as long as her timbers will hang together. They were honestly built ships that were laid down in her time. We remember seeing some 25 years ago, an old convict ship that was brought from Australia to be exhibited around the English coast. She was called the "Success," rather a peculiar name for a vessel devoted to the purpose that she was. At that time, 1895 if we remember rightly, she was said to be 102 years old, and as far as we know she is still in existence, as she went back to Australia afterwards. Her massive timbers were the source of much remark. There were three other old frigates moored in the River Mersey for many years, the "Indefatigable," the "Clarence" and the "Akbar." The "Clarence" was set on fire by some of her boys, she being then in use as a reformatory ship, and burned to the water's edge. Another famous old ship was at Blackpool, the "Foudroyant," and she was later broken up through going ashore on the Blackpool beach. We have in our possession an ornamental copper poker made from a copper bolt from another old vessel, the "Resistance," this bolt being about 30 inches long, and 1 inch diameter, while one end is upset to form a knob. They were as we said, built to last.

A RATHER interesting discussion has been going on in Germany anent the proposed changing of the colors of the mercantile marine ensign. This was familiar all over the world as black, white and red, and the new official flag of the German mercantile marine is black, white and gold. The shipping community have not favored the change, and they have been promoting an agitation in the sea ports to bring back the old colors. They argue that it is their flag, by use and tradition, and under it a very successful merchant fleet was built up. There does not seem to be much point in making the change, and we imagine that in doing so the German officials make a tacit admission that under it deeds were done that they would not wish remembered. When anyone sees the new flag flying at the taffrail of a German ship, they will be more inclined to remember the old one, and its associations. The proposition that the new colors be carried in the corner of the old flag seems to us to be without reason, and to be a sort of hybrid compromise.

THERE are at present under construction in German shipbuilding yards no less than 600,000 tons of shipping, according to reliable reports. This tonnage is all for German use, none of it being destined for the so-called reparation purposes. Considering the way shipbuilding has slumped in Great Britain, it is not improbable that Germany will very soon be back in her old place as a maritime nation if conditions remain as they are at present. In this connection, it is interesting to note that a leading Tyne side shipbuilder, Sir Arthur Munro Sutherland, stated recently that it soon will not matter at what price ships were built in England, shipowners did not want them. The outlook for shipping was, for the immediate future, very perplexing to him. The cost of production was so high, that the finished material in no way represented in value the money which it had cost. High wages, short hours, laying back on the job, etc., is doing its deadly work. On the other hand, workmen in Germany, are applying to their trade unions to allow them to work more than the stipulated eight hour day. They are working and working hard, and producing ships and other goods at a rate that places them beyond the competition of any other nation.

AN interesting item of news comes from Cardiff, South Wales, that greatest of all coal exporting ports. Belgian coal and Saar Valley coal has actually been landed at Cardiff to enable the trawlers belonging to that port to go on their fishing trips. Some of them had been kept on the job by means of small coal and pit prop ends, but the supply of this was naturally limited, besides which we imagine it must have made a pretty hard time for the stokehold crews. About 800 tons of this foreign fuel was imported, and it is stated that this is the first time on record that foreign fuel has come to Cardiff. The old proverb about carrying coals to Newcastle has been put out of use of late, and it must have been a sorry sight for the striking miners to witness coal being unshipped instead of shipped in Cardiff docks.

BRITISH SHIP BUILDING.

On Wednesday, 8th June, there was launched from the Wallsend Shipyard of Messrs. Swan, Hunter & Wigham Richardson, Ltd., a large cargo boat built to the order of Koninklijke Hollandsche Lloyd and called Montferland. This is the second ship which the builders have recently had in hand for these owners, being a similar ship to the S.S. Amstelland which was delivered last year. The Montferland has a cruiser-shaped stern and is 477 ft. 3 ins. in length overall. Her extreme width is 60 ft. 2¾ ins. and she has a moulded depth of 38 ft. 9 ins. She is being built to Lloyd's highest class and her deadweight carrying capacity will be 9,800 tons on a draft of 26 feet.

Two of the holds are refrigerated for carrying frozen meat while the other three holds are for general cargo. The cellular double bottom of the ship has been built to carry either water ballast or oil fuel. Accommodation is provided for the sailors and firemen in the after end of the ship while the officers and engineers have their quarters amidships.

The propelling engines and boilers have been built by Messrs. Swan, Hunter & Wigham Richardson, Ltd. at their Neptune Engine Works, Walker, Newcastle-on-Tyne. There are five cylindrical boilers 15¾ ft. in diameter fitted with Robinson's patent superheaters and working at a pressure of 200 lbs. per sq. inch under forced draught. The main engines consist of a set of compound turbines of the Metropolitan-Vickers-Rateau type working in series and driving a single propeller through double reduction gearing. The gravity system of lubrication will be used but pressure can be employed in case of need.

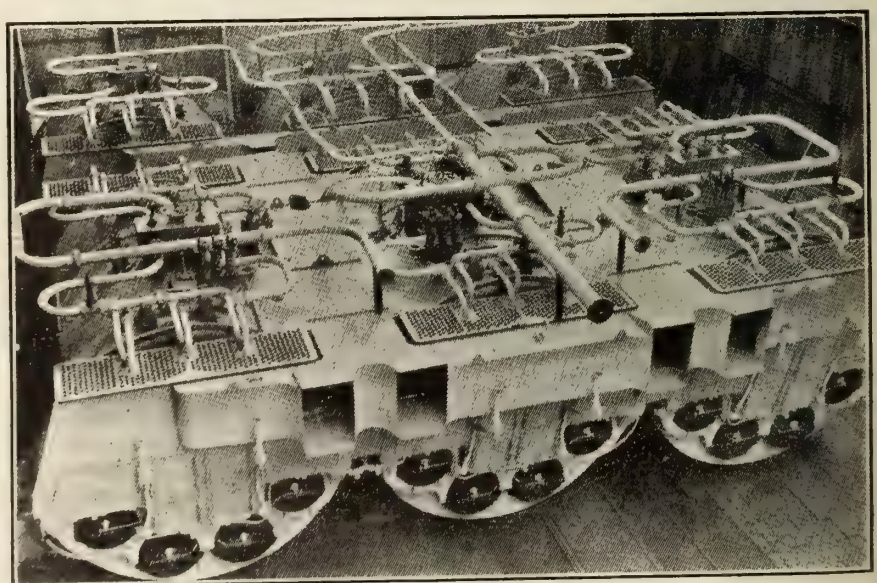
Messrs. Swan, Hunter & Wigham Richardson, Ltd., have just finished the building and engining of a cargo ship, the S.S. Dandolo, a name which recalls the famous exploits of Enrico Dandolo, who in 1193 at the age of 84 years, was elected Doge of Venice. Others of the same family held high office in the palmy days of the Venetian Republic. The Dandolo is to run in the service of the Societa Veneziana di Navigazione a Vapore, of Venice. The trial trip off the mouth of the River Tyne took place on the 10th of June and everything passed off to the satisfaction of all concerned. The ship then returned to the Tyne. On her outward voyage she will be commanded by Capt. A. Giacopello. During the trial trip the owners were represented by their Mr. Bardi and by Mr. London, the assistant of Mr. H. M. Rogers of London, their consulting naval architect.

The Dandolo has a length between perpendiculars of 400 ft. a breadth of 53 ft. 3½ ins. and a moulded depth of 28 ft. 9 ins. The ship is to carry 8,300 tons on a draught of 25 ft 4¾ ins. She is of the shelter deck type and has been built to the highest class of Lloyd's and at the same time conforms to the rules of the British Corporation and of the Registro Nazionale Italiano.

The triple expansion engines driving a single screw and the three boilers working under forced draught have been built at Messrs. Swan, Hunter & Wigham, Richardson, Ltd.

Trans-Pacific trade appears to be slowly improving, so far as shipments from British Columbia ports are concerned. Lumber and pulp are still figuring largely in the exports, and the demand for Japanese squares lumber coninues heavy, although the market for this will probably decline somewhat following the jump in freight rates to $12.-50 a thousand after July 1. A typical cargo was booked by the African Maru, consisting of 500,000 feet of lumber, 500 tons of pulp, some machinery parts and general merchandise. She is booked to sail July 4. The Steamship Canadian Inventor, of the Canadian Government Mercantile Marine fleet, sailed a few days ago with 3,500,000 feet of lumber for India and South Africa, a number of sample shipments of Canadian manufactures and canned fish.

The Patterson-McDonald Shipbuilding Company, of Seattle, has been awarded $1,028,458.66 on ship construction claims against the Australian Government by a board of arbitration appointed by the Australian authorities and the company. Claims of the company arose out of the construction of nine 4,200 ton wooden ships for Australia in Seattle. Under a recent settlement the United States Shipping Board allowed the company $354,000 on claims arising from the cancellation of shipbuilding contracts from the Board. As a result of its difference with the Australian Government and the Shipping Board, the company went into bankruptcy. President A. M. McDonald states that the award will enable the company to pay its creditors dollar for dollar. Most of the vessels involved in the transaction are now operating out of San Francisco, the Comyn interests being in control. The Ocean Motorship Company is the name of the operating concern.



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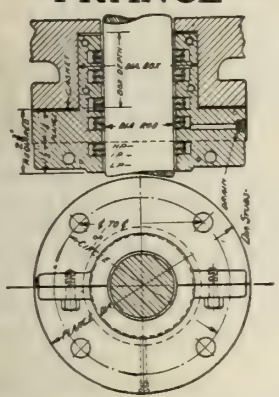
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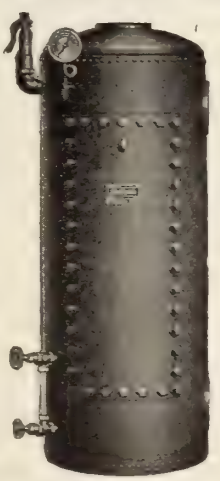
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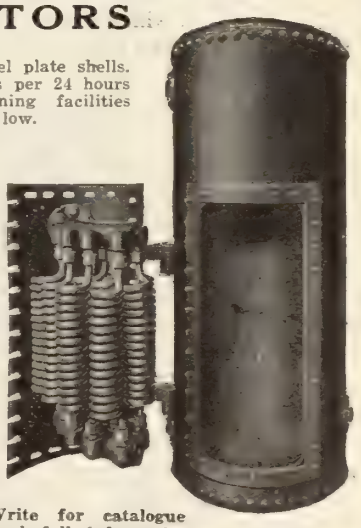
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MARINE NEWS FROM EVERY SOURCE

Port Stanley—The new Port Stanley drydock has now been completed, and is ready to handle the numerous craft that have been awaiting it. The dry dock, which is owned by Oscar Smith and N. S. Cornell of Port Stanley is the only dry dock on the north shore of Lake Erie and should prove to be an excellent asset to the port.

Ottawa:—The Canadian Government, through the Department of Naval Service is suing the New Brunswick Rolling Mills Ltd., of St. John for the balance of the purchase price of the "Niobe" and two obsolete submarines, sold to them for scrap. The amount in question is $115,000. The full purchase price was $135,000 of which only $20,000 has been paid.

St. Catharines: — While passing through the Welland Canal the steamer "William Palmer" of Buffalo, bound for Montreal with a cargo of corn scraped the sill of several of the locks. She finally grounded in Lock No. 6, and had to be lightened before she could proceed. The cause of the trouble was found to be a leak which caused the vessel to draw more than the 14 feet allowable.

Vancouver:—The Royal Mail Steam Packet Co., according to their agent, Col: E. J. M. Nash, are building four 10.000 ton motor vessels for their Pacific trade. The vessels have been delayed owing to the strike in Great Britain or they would already have been on the service. There will be two delivered early in the fall and two more during December, according to latest advices. Col. Nash stated that passenger traffic was very good, but freight conditions just the opposite.

Halifax:—The "Canadian Cruiser" 10500 tons deadweight, built for the Canadian Government Merchant Marine, was successfully launched from the yards of the Halifax Shipbuilding Co. on July 10th. The christening ceremony was performed by Mrs. George H. Murray, wife of the Nova Scotia premier, and a peculiar feature of the launch was that the christening fluid was brine from the Pacific Ocean. The vessel thus received her baptism in the waters of the Atlantic and Pacific at the same moment. The water was sent by Mayor R. H. Gale, of Vancouver.

Oswego:—A peculiar accident happened to the tug, "Dillwin" while entering the harbor here towing the barge "Georger." The tug after getting sufficient way on the barge slipped her tow line and attempted to get out of her tow's way, when she struck a shoal. The barge coming along close astern of the tug rolled her over on the sand bank, and the wife and child of the tug's captain who were aboard, had a narrow escape from drowning. The cabin and engine room were filled.

Quebec:—The Davie Shipbuilding & Repairing Co., Lauzon, P.Q., launched on July 7th the steamer "Canadian Challenger," one of the 8,350 ton class of the Canadian Government Merchant Marine fleet. The vessel is fitted with oil burning furnaces in the three boilers.

Washington: —The United States Shipping Board has decided to sell off the Government fleet of wooden ships, consisting of about 287 vessels, and bids have been asked for. Most of these ships are at present tied up in the neighborhood of Newport News and the James River. Tenders will be opened on July 30th.

London:—A report was received that the U.S. steamer "Western Front" bound from Jacksonville for London and Hamburg, was on fire six miles off the Bishop Rock on the south west cost of England, and was beyond assistance. When ten miles off the Bishop Rock an explosion occurred in the hold, followed by fire. The steamer "British Earl" rescued the crew, several of whom were injured and one missing, and transferred them to a lifeboat from St. Mary's, where they were landed.

Toronto:— The roller boat Knapp which has been lying here off the Polson Iron Works yard for many years, is at last to be broken up for scrap. Work will be commenced when the ice forms sufficiently to hold the workmen, who will cut the boat down with the oxy-acetylene torch. The Knapp roller boat was invented about 24 years ago, and was supposed to roll over the water in much the same way that a caterpillar tractor rolls over the ground. The boat cost about $30,000 to build, but was found to be a failure, and has laid at her present moorings ever since. She will be worth about $500 as scrap.

Quebec:—The Canadian Pacific Ocean Services have acquired the ex-German liner "Kaiserin Auguste Victoria" and will rename her "Empress of Scotland," after which she will be assigned to the St. Lawrence route. The new vessel will be the largest on the Canadian route, being 25,000 tons gross, and her dimensions are; Length 700 feet, breadth 77 feet, and draft 34 feet. She has accommodation for three classes of passengers.

Midland:—The Georgian Bay Shipbuilding and Wrecking Co. have successfully raised the tug "Wahnapitae" owned by C. Beck & Co., Penetang which sank after striking a rock in the vicinity of Clapperton Island. This success follows the failure of a Soo wrecking company to raise the boat, and the loss of one of their divers through a leaky helmet.

Overseas and inter-coastal freight rates continue to decline as tonnage becomes avialable in growing volume. Following the recent cut in lumber, wheat and flour rates between ports on the B. C. coast and the orient, the rate of tea has also undergone a reduction as a result of the under-bidding of the Mitsui Bussan Kaisha. The new rate is $8 a ton, compared with $10 a ton last year.

Direct service between North Pacific coast ports and Europe will be inaugurated by the Royal Mail Steam Packet Company with the new 15,000 ton motorship Somersetshire, first of a fleet of motorships commissioned by the British Company, which is due to arrive on the coast July 25. The Somersetshire left London June 20, sailing via the Panama Canal. She has limited passenger accommodation, so that she is the first ship that has enabled passengers to travel from British Columbia and Puget Sound ports to Europe via the Panama Canal. Another vessel of the Royal Mail Line is the Moliere, one of the Lamport & Holt liners, which has been assigned to the Pacific-European service. She is expected to reach these waters in October. The Holland-American Line is operating a fleet of cargo-carriers in conjunction with the Royal Mail ships. The steamship Eemdijk was the first to come to the coast in this service. The Keemdijk is following the Eemdijk, having sailed from London June 8. The Keemdijk is bringing liquor for the British Columbia Liquor Control Board, glass and glassware from Belgium and knitting machines and needles from Hamburg, Germany.

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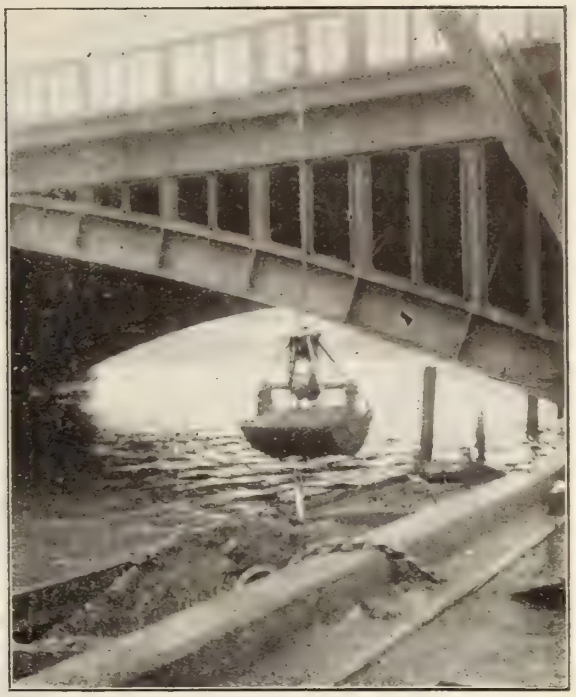

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I have no hesitation in saying that this packing is good for six months used under conditions as above.

I am,
Yours truly,
(Sgd.) W. J. Mitchell,
Chief Engineer S. S. "Chaleur"

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OIL BURNING TUGS

Two tug boats owned by the Sincennes-McNaughton Line, Limited, of Montreal, have recently been converted from coal burners to oil burners.

The two tugs are the "VIRGINIA" and the "FREDMAC", both of which were built in 1919 at Sorel, and are amongst the largest vessels of the "Sinmac" Line. They are the only oil burning tugs in Montreal Harbour.

The oil burning system which has just been installed is the "Todd" Assisted Draft system. The equipment is exceedingly compact, is easily operated, and the minimum amount of space is occupied by the pumps and other parts owing to the care taken in designing and making the installation.

The results achieved by converting these two tugs to oil burners have been highly satisfactory, and the flexibility and convenience of burning oil in tug boats as against burning coal have been fully demonstrated. It has been proved that for intermittent work, such as a tug is called upon to perform, oil as a fuel has many advantages over coal. As is well known, oil is more economical than coal, also its adoption permits a reduction in the number of crew carried.

The "VIRGINIA" and "FREDMAC" are daily doing heavy and light towing in and around Montreal, and the oil burning equipment is working splendidly.

The Canadian agents for the "Todd" and "White" Oil Burning Systems are N. E. McClelland & Company, Limited, 286 St. James Street, Montreal, and the equipment for the above tugs was manufactured in Montreal under their direction, by the Mason Regulator & Engineering Company, Limited, and installed by the Sorel Mechanical Shops.

The "White" and "Todd" Oil Burning systems are now being fitted in some of the new vessels for the Canadian Government Merchant Marine.

Toronto:—The Collingwood Shipbuilding Co. launched from the yards of the late Dominion Shipbuilding and Repairing Co. at Toronto the Canadian Government Merchant Marine steamer "Canadian Engineer." This is the last vessel to be launched in Toronto, from present appearances for a long time to come. The "Canadian Engineer" is of the usual Welland Canal size similar to the other vessels built here. The boilers and engines were built by the John Inglis Co. Toronto.

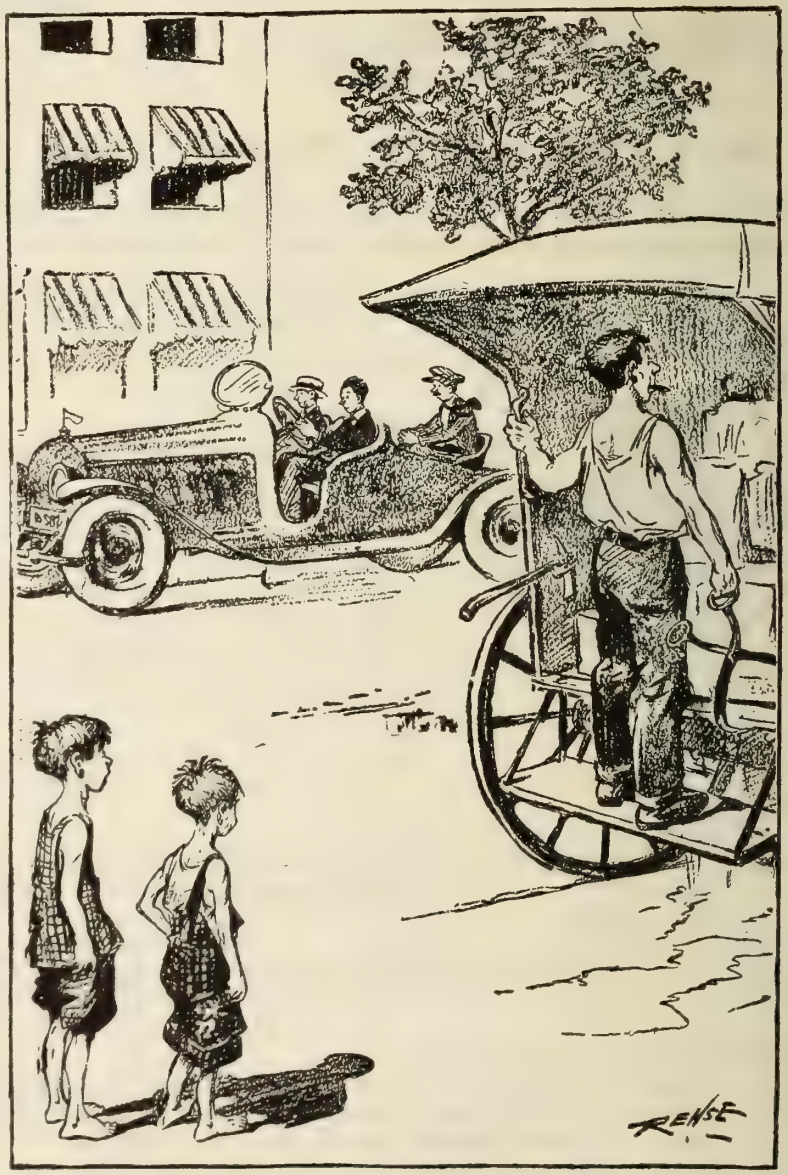
The Canadian Government Mercantile Marine, Ltd., has announced that the steamship Canadian Prospector, en route home from Egypt will put in at Trinidad to load sugar raws for the B. C. Refinery at Vancouver. The Canadian Traveller, a Victoria-built steel ship, is also on her way back from Egypt. Both vessels carried railway ties for the Egyptian state railways. The Canadian Importer is steaming up the coast from the Panama Canal to load lumber in British Columbia for Australia. The Canadian Exporter is due to arrive shortly from Australia. The Canadian Winner, another Victoria product, is at Adelaide, South Australia. The Canadian Highlander is due at Taku Bar with lumber from this coast. The Canadian Inventor is due at Moji, Japan, for coal. The Canadian Skirmisher, now on her maiden voyage, is at Auckland, N. Z. The Canadian Farmer is in the Canal zone at the time of writing, and she will be assigned to the Oriental service. The Canadian Observer is now loading at Port Alberni and will carry lumber to Montreal.

DEFEND YOUR STEAM

The Magnesium Association of America have issued a book with the above title, setting forth the uses and merits of 85% magnesium. In the preface it is stated that the book is for the use of the architect, engineer, and owner, to assist them in the conservation of fuel by proper insulation of steam pipes etc. The book contains short articles on heat insulation and losses, the selecting of proper insulating material, etc. There are a large number of very good illustrations showing magnesia in various services, including a number taken in Canadian plants. The book is strongly bound and should be much appreciatel by the profession it is dedicated to.

NEW BOOKS

The Combustion Engineering Corporation have printed in booklet form the paper read before the American Iron and Steel Institute in New York in May last. This is stated by the Combustion Company to be the most complete summary of powdered coal progress that they have yet issued. The paper describes in detail the various types of equipment, the results achieved up to the date of the paper, and a general history of the progress of this new method of using coal fuel. The booklet is issued with the compliments of the Combustion Engineering Corporation, Broad Street, New York.



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"Naw, not for me. Give me de job as chauffeur on an ice wagon."

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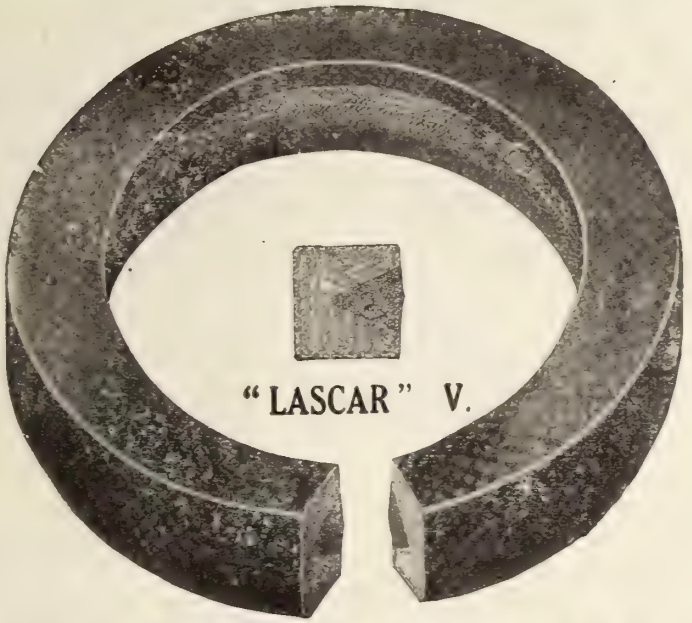

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Notes From Sorel

Mr. Joseph Hamelin, inventor of the Steam Reversing Turbine, made a trial of his turbine recently and a diagram was made of the test. At that time, it was connected to a boiler with a pressure of 95 pounds and the indicator showed 9.75 indicative horse power, which corresponds to the brake horse power formerly ascertained. The turbine developed 409 r. p. m. against a resistance. Mr. Hamelin is having drawings made of his turbine to develop 600 H. P. and we hope to be able to publish the illustration of same with full details and specifications in our next number. Several engineering concerns have asked information from Mr. Hamelin in connection with his turbine, and he has cheerfully sent same to all who asked for it.

Dredge No. 16 of the Government Fleet, Department of Marine, which was in the Port of Sorel for over two years, has been sent to Vickers where she will be completed.

The steamer Lavaltrie, of the Dept. of Marine, has been sent to Ile Rouge, in the Saguenay, to relieve the light-ship which is being repaired. As the work on the light-ship will take about seven weeks, the Lavaltrie will remain there that length of time.

It is rumored that a spoon dredge will be put to work in the Port of Sorel to rake the bottom of the Richelieu river near the place where the Dansereau Pulp Mills will be erected. At that place, there are several wrecks resting on the bottom of the Richelieu and this will afford a better landing and facilitate work all around.

A trawler partly finished by the Leclaire Shipbuilding Co., now owned by the Transportation and Shipping Co. Limited, being construction No. 16, has been turned into a tug, with all equipment and apparatus for an able seagoing tug. This tug will be ready in two or three weeks to go into commission. Machinery and equipment of same have been duly inspected and reported in first class condition.

Mr. F. X. Hamelin, District Steamship Inspector, has just returned from an inspection trip in Lake St. John. He was absent from Sorel nearly two weeks, and inspected quite a number of steamboats in that vicinity.

Owing to an accident to her machinery, the Rapids Prince went ashore in the Long Sault and the Rapids Queen will be sent there Tuesday the 19th inst. to replace her.

Montreal:—The sailing of the "Megantic" of the White Star Dominion line on the 17th, marks the fiftieth anniversary of that company. The first sailing was made to Montreal in 1871 by a steamer of the line which was then known as the Mississippi and Dominion Steamship Co. In those days the winter ports were Boston and Baltimore.

Victoria:—It is stated here that the Japanese firm Nippon Yusen Kaisha have placed an order wth a Clydeside shipbuilding firm for a large Pacific liner to compete with the C. P. R. vessels on the trans-Pacific run. The other large Japanese line, the Toyo Kisen Kaisha, which runs a service between San Fransisco and Japan, has lately purchased several of the ex-enemy liners and this it is thought has acted as a further spur to the Nippon Yusen Kaisha.

Sarnia:—There will be a great improvement in navigation conditions with the completion of the new channel at the St Clair River, which will be very shortly completed. Inspection by the Federal authorities revealed but a few large boulders in the channel, and these are being removed by the large orange peel dredge which has done most of the work. With the completion of the channel, instead of up and down bound boats using the same channel, there will be a passage for up bound boats on the Sarnia side, and down bound on the Port Huron side.

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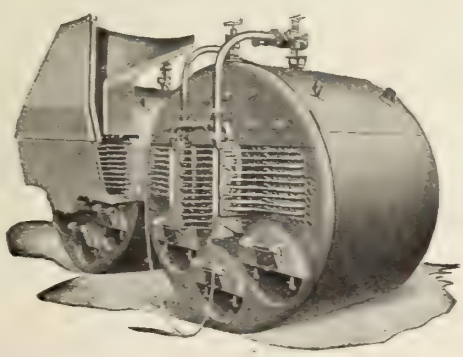

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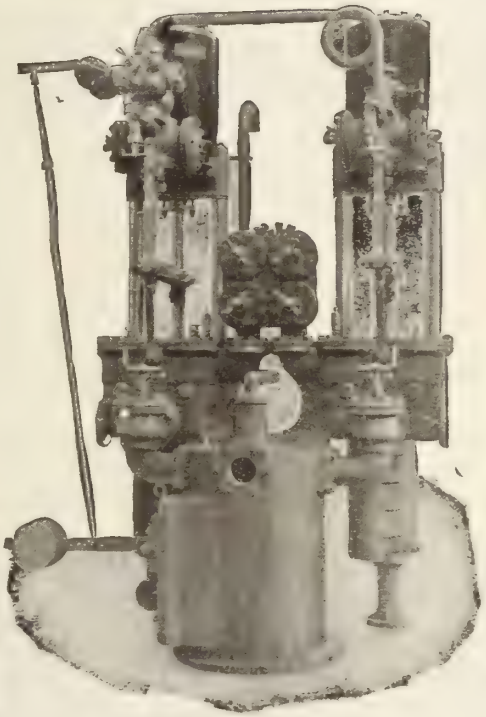

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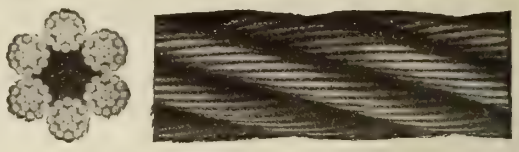

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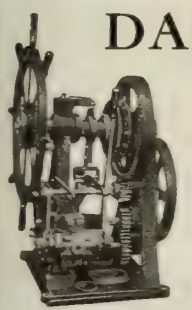

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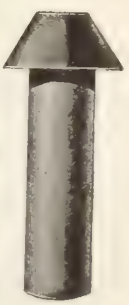

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MILLER'S BOILER CLEANING EXTRACT

R. C. Miller Oil & Supply Co.
Montreal.

May 5th.

Gentlemen:

Replying to your inquiry regarding results obtained from the use of your "Boiler Cleaning Extract" in our steam boilers.

We are pleased to be able to state that we have had entire satisfaction, and that this "Extract" has removed all of the scale from our boilers, and prevented any from again forming, and also that there has been no damage whatever caused to any part of the boilers, including the Tubes, Plates, Joints, Valves, Packings, or Brasses.

We find that it was a good investment as it reduced the consumption of coal, lengthened the life of the boilers and saved costly repairs.

Yours respectfully,
(Signed) Sherwin-Williams Co. of Canada, Ltd.

R. C. Miller Oil & Supply Co.
MONTREAL

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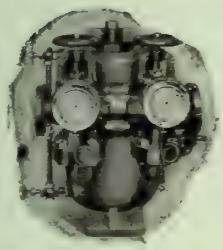

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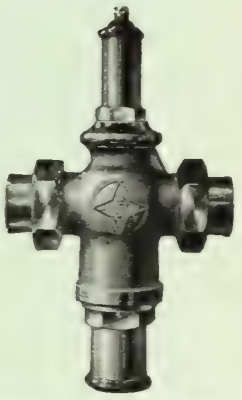

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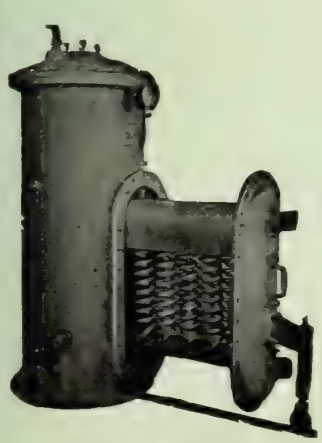

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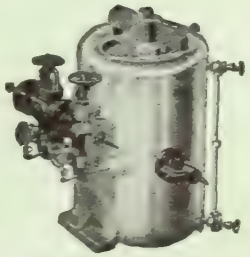

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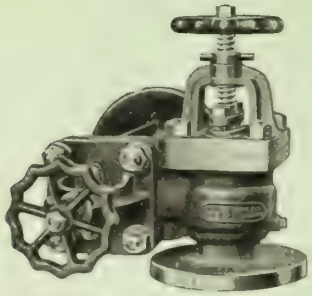

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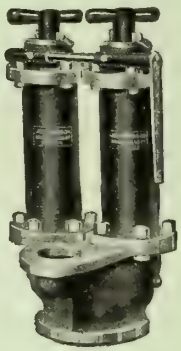

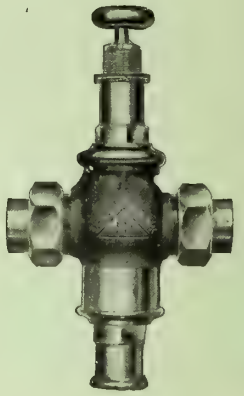

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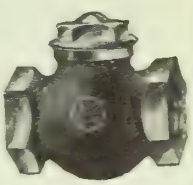

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Keep Your Boilers Clean

What the Sherwin-Williams Co., Ltd., largest manufacturers of paint in America, say about

MILLER'S BOILER CLEANING EXTRACT

R. C. Miller Oil & Supply Co.
Montreal.

May 5th.

Gentlemen:

Replying to your inquiry regarding results obtained from the use of your "Boiler Cleaning Extract" in our steam boilers.

We are pleased to be able to state that we have had entire satisfaction, and that this "Extract" has removed all of the scale from our boilers, and prevented any from again forming, and also that there has been no damage whatever caused to any part of the boilers, including the Tubes, Plates, Joints, Valves, Packings, or Brasses.

We find that it was a good investment as it reduced the consumption of coal, lengthened the life of the boilers and saved costly repairs.

Yours respectfully,
(Signed) Sherwin-Williams Co. of Canada, Ltd.

R. C. Miller Oil & Supply Co.

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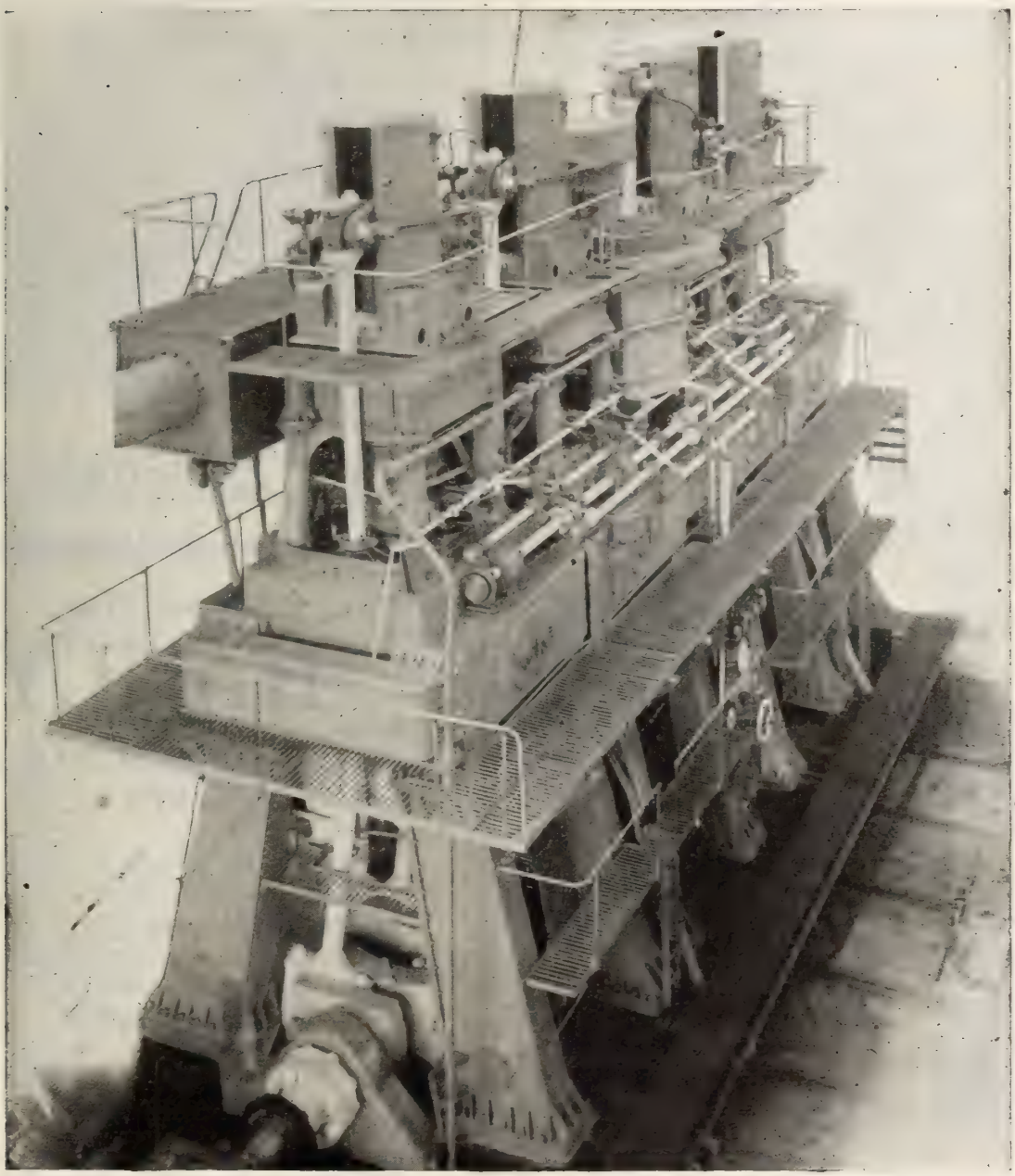

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Leaking piston
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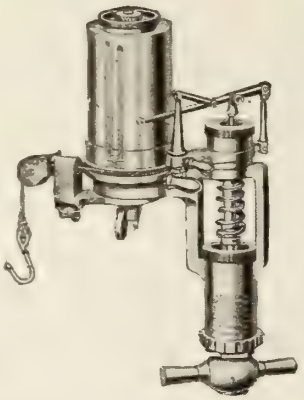

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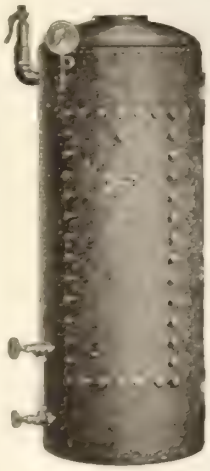
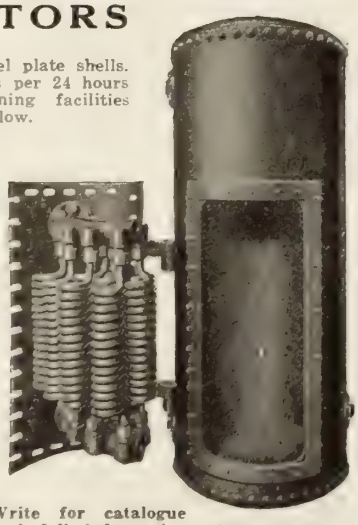


Heater



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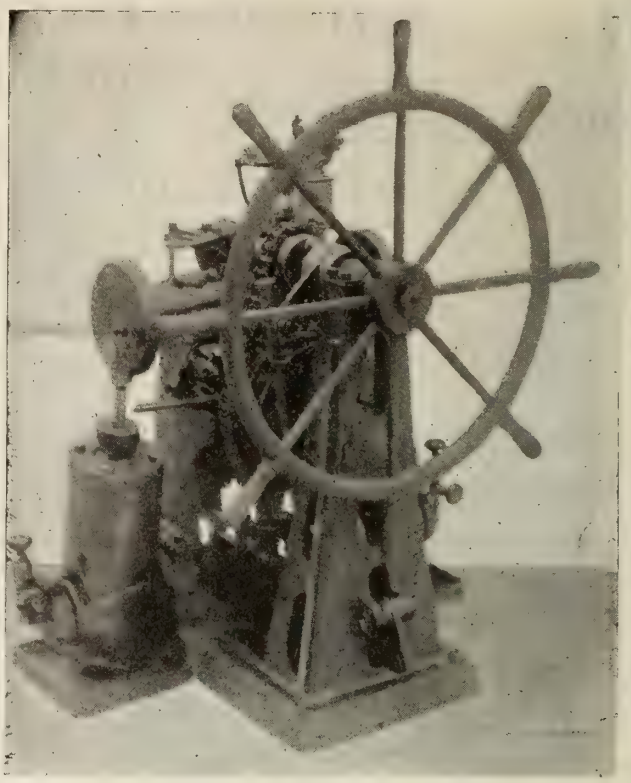

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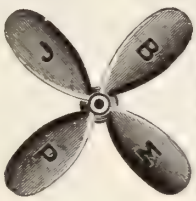

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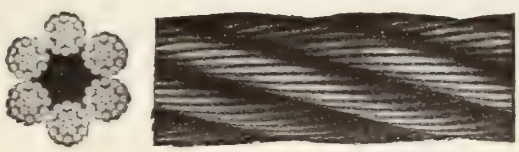

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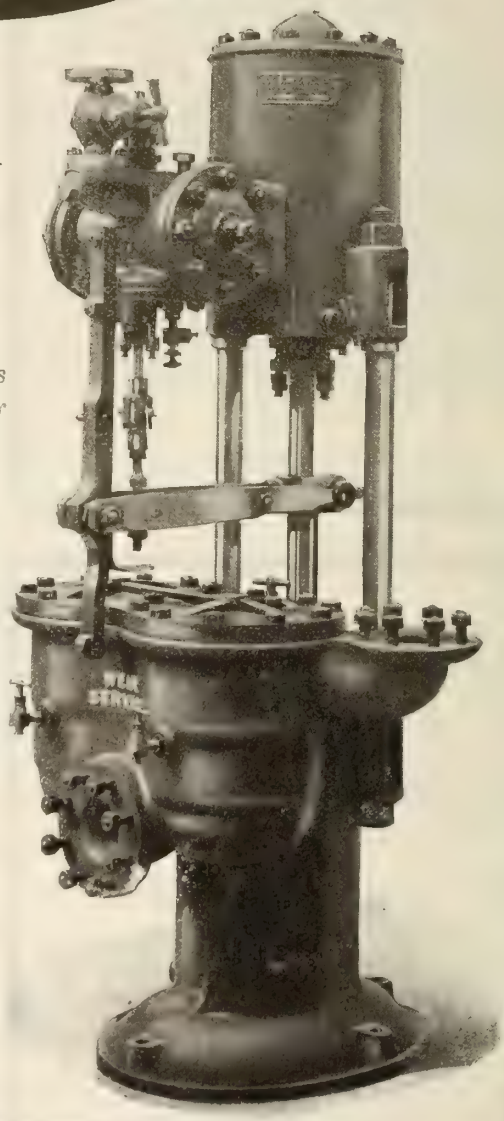

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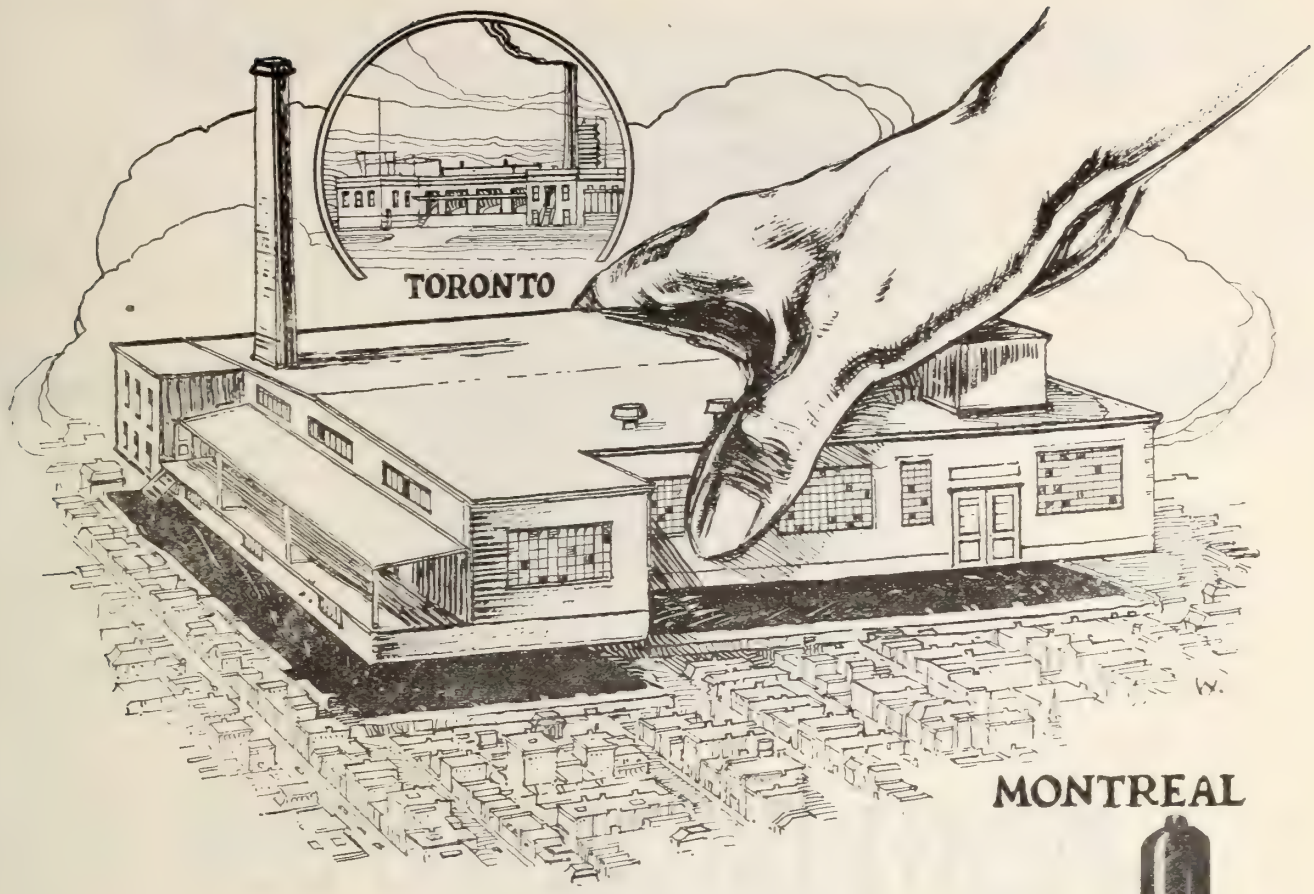


"Planting" Another Milestone

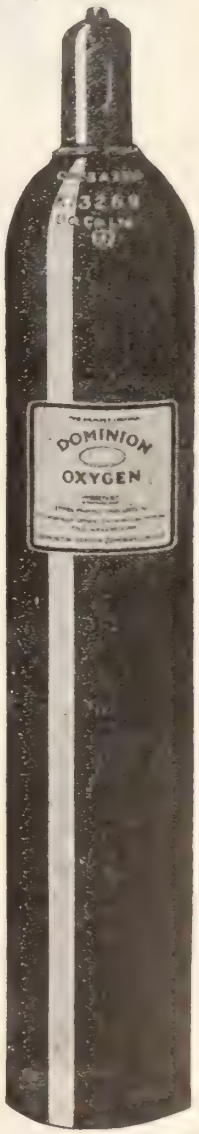
The Dominion Oxygen Company Limited announces the achievement of another milestone in its 1921 building program.

In July ground was broken in Montreal for a second large oxygen producing plant. Located at Magdalen, Lieber and Bourgeois Streets, this producing unit will have 10,000 square feet of floor space and will supplement the output of our Toronto plant by a 100 per cent. increase.

This expansion in manufacturing facilities will enable us to supply not only our regular patrons' steadily increasing demands for this highest purity product; but the needs of those who have wanted Dominion Oxygen and could not secure it.

And with the doubling of our producing machinery — employees and equipment—Dominion Oxygen consumers receive double insurance that our policy of filling all orders on the day of receipt will be rigidly maintained.

No matter where your location or what your requirements, an order dispatched to the nearest plant or distributing station — there are six of them—brings you the purest oxygen through the quickest service in the Dominion.

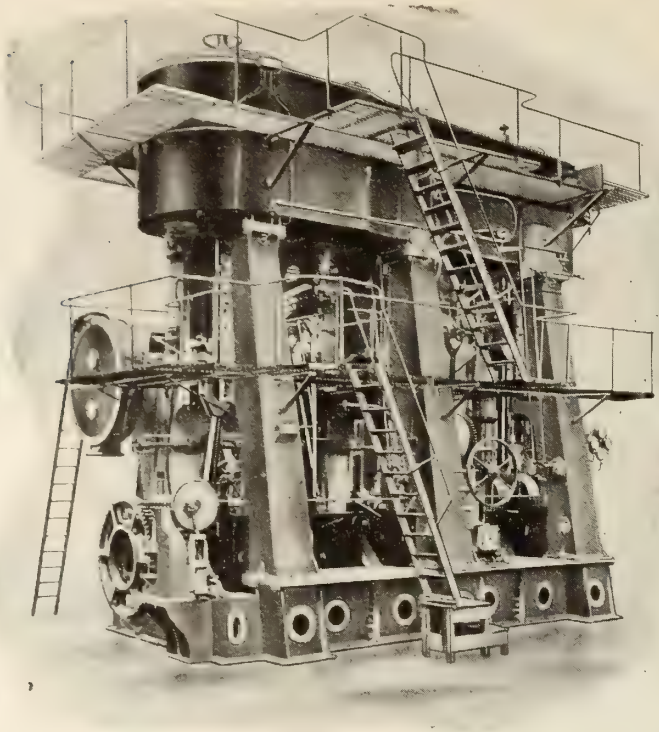


Dominion Oxygen Company, Limited

Hillcrest Park, Toronto

Hamilton, Merritton, Montreal, Welland, Windsor.

D20



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MARINE ENGINEERING
OF CANADA

Vol. XI. AUGUST, 1921 No. 8

A Guide to the Canadian Marine Certificate

In This Instalment the Lessons on Vulgar Fractions and Decimal Fractions Are Continued, and the Way Cleared for the Introduction of Involution and Evolution

By T. H. FENNER

CONTINUING at the place where we left off in the last article, we will go further into the use of signs in solving arithmetical problems. It is important that these be thoroughly understood. Take the following example:-

$$x = 4\{3+[6\times 9-(2+4+3\div 3)]\}$$
$$x = 4\{3+[6\times 9-(9\div 3)]\}$$
$$x = 4\{3+[6\times 9-3]\}$$
$$x = 4\{3+[54-3]\}$$
$$x = 4\{3+51\}$$
$$x = 4\times 54$$
$$x = 216$$

Note:- The quantity in the bracket preceded by a minus sign (9÷3) will be −(+3), the plus sign of course being understood. When the bracket is removed, the sign of the quantity or quantities in the bracket must be changed. This only applies when there is a minus sign before the bracket.

The rule to observe is always to simplify the expression in the innermost bracket first of all, and when simplifying any expression to perform the indicated multiplication first and the addition and subtraction afterwards. We have not dealt with the last sign of aggregation, the vinculum, because it is seldom used, except in the case of the radical or root signs.

Having made clear the use of the signs, a few examples of complex fractions will be given, after which it will be possible to give the decimal system a little study.

Some Examples of Fractions

$$\frac{\frac{7}{16}+\frac{3}{8}\div\frac{9}{27}}{\frac{5}{32}\times\frac{7}{8}+\frac{1}{2}}\div\frac{3}{4}$$

In the above example the first step will be to multiply together the second and third terms of the numerator of the compound fraction, that is 38 and 27/9, and then add the product to the first term which is 7-16ths. Then proceed to simplify the denominator, by first multiplying the first and second terms together, and adding the product to the third term. Then bring the whole compound fraction to its simplest form, and multiply by 4/3. The various steps necessary are shown below.

$$\left\{\begin{array}{l}\frac{7}{16}+\frac{3}{8}\times\frac{27}{9}=\frac{7}{16}+\frac{9}{8}\\ \frac{7+18}{16}=\frac{25}{16}\end{array}\right\}1$$

$$\left\{\begin{array}{l}\frac{5}{32}\times\frac{7}{8}+\frac{1}{2}=\frac{35}{256}+\frac{1}{2}\\ \frac{35+128}{256}=\frac{163}{256}\end{array}\right\}2$$

$$\left\{\frac{\frac{25}{16}}{\frac{163}{256}}\div\frac{3}{4}=\frac{25}{16}\times\frac{256}{163}\times\frac{4}{3}\right\}3$$

$$\frac{25\times\overset{16}{\cancel{256}}\times 4}{\underset{1}{16}\times 163\times 3}=\frac{1600}{489}$$

$$\frac{1600}{489}=3\,\frac{133}{489}$$

Let us take another example:—

$$\frac{\frac{4}{3}\left\{\frac{5}{8}+\left[\frac{5}{16}-\frac{2}{3}\times\frac{1}{4}\left(\frac{3}{8}+\frac{7}{16}+\frac{3}{4}\right)\right]\frac{1}{2}\right\}}{\frac{4}{5}+\frac{3}{8}+\frac{1}{2}+\frac{3}{4}}$$
$$\frac{16}{32}+\frac{7}{32}$$

The first thing to do is to simplify the expression in the inside brackets. The expression then will be:—

$$\frac{4}{3}\left\{\frac{5}{8}+\left[\frac{5}{16}-\frac{2}{3}\times\frac{1}{4}\left(\frac{25}{16}\right)\right]\frac{1}{2}\right\}$$

Next take the figures in the second bracket and simplify them.

$$\frac{\frac{4}{3}\left\{\frac{5}{8}+\left[\frac{5}{16}-\frac{2}{3}\times\frac{1}{4}\times\frac{25}{16}\right]\frac{1}{2}\right\}}{\frac{4}{3}\left\{\frac{5}{8}+\left[\frac{5}{16}-\frac{50}{192}\right]\frac{1}{2}\right\}}$$

Now eliminate the remaining inside brackets, and the expression will be:—

$$\frac{\frac{4}{3}\left\{\frac{5}{8}+\frac{5}{96}\times\frac{1}{2}\right\}}{\frac{4}{3}\left\{\frac{5}{8}+\left[\frac{5}{16}-\frac{50}{192}\right]\frac{1}{2}\right\}}$$

The remaining step will be to multiply the second, third and fourth terms in the bracket together, and add them to the first term, the resulting sum being then multiplied by 4/3.

$$\frac{4}{3}\left\{\frac{5}{8}+\frac{5}{192}\right\}=\frac{4}{3}\times\frac{125}{192}=\frac{500}{576}$$

The numerator has thus been brought to its lowest form, and we must now proceed to do the same thing with the denominator. Thus we first take the numerator of the compound fraction which is the denominator of the whole, and simplify it:—

$$\frac{4}{5}+\frac{3}{8}+\frac{1}{2}+\frac{3}{4}\div\frac{16}{124}+\frac{7}{32}$$

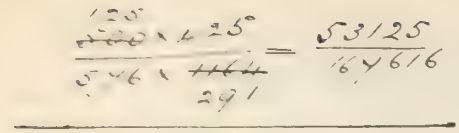
$$\frac{32+15+20+30}{40}\div\frac{64+21}{96}$$

$$\frac{97}{40}\times\frac{96}{85}=\frac{1164}{425}$$

The whole sum will now appear as follows:—

$$\frac{\frac{500}{576}}{\frac{1164}{425}}=\frac{500}{576}\times\frac{425}{1164}$$

and when brought to its final form:—



This final result is in its simplest form, and cannot be reduced.

The foregoing examples should suffice to show how fractions are solved, or rather how fractional expressions are solved.

All fractions are solved by the same rules, and it is but a matter of thoroughly understanding these rules, and remembering them. The first step is always to bring every expression to its lowest possible form. Expression in brackets must be simplified first, starting with the innermost brackets. Terms with the multiplication sign between them must be simplified before any others, and in this connextion remember that the division sign is but multiplication of the invested expression so that division follows the same law as multiplication. Simplify the numerator, by reducing all their several expressions to their lowest terms, and then proceed to simplify the result following the same rules.

Decimal Fractions

The next thing for the student to take up and become familiar with are decimal fractions, which however, are much more simple than the fractions just dealt with. On this account they are much more in use than common fractions, and all the operations can be performed much more easily and with less chance of error by using decimals. Multiplication and division can be performed by merely moving the decimal point in lots of cases. While a whole number can be divided into any number of parts by a vulgar fraction such as sixteenths, eighths, thirty seconds, etc., decimal fractions are always in tenths or multiples of tenths, that is hundredths, thousands, tens of thousandths, etc.

The decimal fraction is shown by placing a small dot before it, about the centre of the figure, although in printed works it is sometimes placed at the bottom. The figures following the decimal point descend in value, in exactly the opposite manner to that in which the figures to the left of the point ascend. Thus in the case of integral numbers, we have, say, 1234. The 4 is the unit figure, the 3 has ten times the value of the unit, while the 2 has one hundred times the unit value, and the 1 has one thousand times. Now if we put down the same figures, but place before them the decimal point, we shall have the 1 representing one tenth of the unit value, the 2 will be one hundredth part of the unit value, the 3 will be one thousand part, and the 4 will be one ten thousandth part, of the unit value. The expression 1234.1234 would read literally One thousand, two hundred, and thirty-four, and one thousand two hundred and thirty four ten thousanths. Expressed as a whole number and a vulgar fraction it would be:—

(1) 1,234

(2) 1,234———

(3) 10,000

From this we can follow out the rule for decimal fractions. The figure immediately following the decimal point can be considered as the numerator of a fraction whose denominator is ten. Thus .1 is 1/10 .2 is 2/10 etc. The second figure after the point has 100 as a denominator, thus .02 is the same as 2/100, and the expression.12 would read 12/100. Thus to convert a decimal fraction into a vulgar fraction, the decimal itself becomes the numerator, and the denominator is obtained as follows. For the decimal point the figure 1 is placed in the denominator, and for every figure following it a cipher is placed. Thus to convert the decimal .125 to a fraction, we place 125 as the numerator, and the denominator will be 1,000, the fraction being 125/1000, which being reduced becomes 1/8th. Now if there is a cipher following the decimal point, or two ciphers, or any number before an integral figure is reached, proceed just the same way. For instance, if the decimal was .0125, we should have as our vulgar fraction 0125/1m, and as the cipher in the numerator means nothing we can leave it out, and the fraction is 125/-10,000. If the decimal is .00125 the vulgar fraction would be 125/100,000. These three fractions reduced would be, taking the first example again, 1/8th the second 1/80, and the third 1/800. The above will serve to show also that in decimals the cipher occupies a very important place.

In order to add together decimal fractions, all that is necessary is to set them down as one would any ordinary sum in addition, care being taken to keep them in their correct relative position to the point. For instance, in adding .5 to .05 the figures must be set down thus:

.5
.05

and the addition performed in the orlinary way:—

.5
.05
———
.55

This really means that 5/10 has been added to 5/100, and the resulting sum is 55/100. The sum in vulgar fractions would be

$$\frac{5}{10} \times \frac{5}{100} = \frac{50 \times 5}{100} = \frac{55}{100}$$

Again add .345 to .123. We get:

.345
.123
———
.468

Now take .75 and .25, added together. This will be

.75
.25
———
1.00

Here we have a sum which gives a whole number. Whenever the sum of the two first figures is more than 9, then the unit figure is set down and ten carried over, as in the ordinary way, but to the left of the decimal point. Let us take some whole numbers and decimals to illustrate this point. Take 2.75+.5. We have

2.75
.5
———
3.25

or again 1.25+2.75

1.25
2.75
———
4.00

Another example: 2.34+1.25+2.68

2.34
1.25
2.68
———
6.27

Add 2.3456, .0031, 1.002, 4.106, 5.00005. This will be

2.3456
.0031
1.002
4.106
5.00005
———————
12.45675

Subtraction of decimals is performed in the same way. The figures are set down with due regard to the place of the decimal point and subtraction performed just as with whole numbers. Thus to subtract .016 from .123 the work is as follows:

.123
.016
———
.107

Take from 2.345, 1.203

2.345
1.203
———
1.142

Subtract 346.007 from 458.0103

458.0103
346.007
———————
112.0033

Subtract 369.0035 from 461.0045

461.0045
369.0035
———————
92.001

The cipher after the figure, is omitted, as it means nothing. Remember a cipher at the end of a row of decimals means nothing, but a cipher at the beginning means a whole lot, as it alters its meaning considerably. Thus .1000000 is only .1, but .00001 instead of meaning 1/10, means one hundredth thousandth.

Multiplication of Decimals

In multiplying decimals the same rules apply as in ordinary multiplication, the only precaution necessary being the placing of the decimal point in its proper place, in the product. The sum to be multiplied is set down in the ordinary way, and the multiplication performed in the ordinary way. The position of the

decimal point is found by adding together the number of figures after the decimal point in the multiplier and multiplicand, and counting off that number of figures from the left hand end of the product. The decimal point is placed before the last figure thus counted. The following example will illustrate quite clearly our meaning. Multiply .75 by .25.

.75
.25

375
150

.1875

There are two figures after the decimal point in both the multiplier and multiplicand, so in the product there will be four figures after the decimal point. There are one or two points to watch in multiplying decimals, which have a very important effect in the sum, and are in themselves very simple. For instance, in multiplying .555 by .004 the product will be:—

.555
.004

2220

Here we have six figures after the decimal points in the multiplier and multiplicand, and only four figures altogether in the product. In order to get our decimal point in the correct place we must have at least as many figures in the product as in the multiplier and multiplicand. We must therefore add two ciphers to the left hand end of the product, which will give us six figures, and then place the decimal point in position. The sum will therefore appear as

.555
.004

.002220

Now there is another thing to notice. We have said that a cipher at the right hand end of a decimal quantity means nothing, and this is quite right. But notice. If we had struck off the cipher in the product before adding our two ciphers, we should have had only three figures in the product, and should have had to add three ciphers instead of two to get the right quantity, and the product would then have been .000222, instead of .00222, the correct answer. Therefore always remember in multiplication, to place the decimal point in its correct place before striking off any ciphers at the end of the product.

Bearing these points in mind, the whole science of multiplying decimals is covered. Briefly expressed the rule is, set down the sum in the ordinary way, carry out the multiplication in the ordinary way, and place the decimal point in the product by counting from the left hand end of the product a number of figures equal to the sum of the number of figures after the decimal point in both multiplier and multiplicand. If there are not sufficient figures in the product, add ciphers to the left hand end until the required number of figures are obtained. Do not strike off ciphers at the right hand end of the decimal quantity until the decimal point has been placed.

Division of Decimals

When we come to the division of decimals the problem is just as simple. Division of decimals is performed in just the same way as ordinary division, first noting that there are as many figures after the decimal point in the divisor as in the dividend, and if not, add ciphers until there are. The position of the decimal point in the quotient is determined in a somewhat different manner to that in the multiplication sum. It will be easier to show this by means of examples.

Suppose that we wish to divide .4 by .2. Here we have just one figure behind the decimal point in each case. We therefore neglect the decimal point altogether, and divide in the ordinary way the sum being:—

2)4(2

The quotient being 2, not .2. This result is important. We will show by fractions that it is quite correct.

$$\frac{4}{10} \div \frac{2}{10} = \frac{4}{10} \times \frac{10}{2} = \frac{4}{2} = 2$$

It means simply that 2/10 are contained in 4/10 twice.

Now let us divide .2 into 4. Here we have one figure after the decimal point in the divisor, and no decimal point in the dividend. We must therefore place a cipher after the figure 4 in the dividend when our condition will be satisfied, and the sum will be

.2)4.0(

which, eliminating the decimal points becomes

2)40(20

Let us now reverse this sum and make it 2 into .4. Here we must place the cipher after the 2 to make both sides the same, and thus we have

2.0).4(

This will read, eliminating the decimal points:

20)4(

Now we may say, it is impossible to divide 20 into 4, but of course it is not. What we must do is to place a decimal point in the quotient and add a cipher to the 4 in the dividend, thus:

20)40).

We can now divide the 20 into 40 and the answer is .2. Let us again prove this by fractions. We have

$$\frac{4}{10} \div \frac{2}{1} = \frac{4}{10} \times \frac{1}{2} = \frac{4}{20} = \frac{1}{5}$$

and as .2 is equal to 2/10 or 1/5 we see that both are the same. Let us carry this a step further, and divide 4 into .2. Here we shall have, when the two are equalized as to the decimal point,

40)2(

Now we place a decimal point in the quotient and add a cipher to the dividend, and we have

40)20(.

but again we cannot divide. We must now place a cipher after the decimal point in the quotient, and add another cipher to the dividend, thus:

40)200(.0

and we can now divide the quotient being

40)200).05

This illustrates the method employed, and we will give a few more examples in order to make it clear.

Suppose we have to divide 2.25 by 1.005. We have one figure more after the decimal point in the divisor than in the dividend, so we must add a cipher to make them even, and we have then

1.005)2250(2
2010

240

We thus have the remainder, and in order to proceed with the sum to its conclusion, we place a decimal point after the figure 2 in the quotient, and add a cipher to the remainder, and then proceed as before

1005)2250(2.2
2010

2400
2010

390

In order to carry the division still further, we add a cipher again to the remainder, and proceed, and we carry this on as long as necessary.

1005)2250(2.2388
2010

2400
2010

3900
3015

8850
8040

8100
8040

60

Now when we come to the last remainder, 60 and add a cipher to it it is still indivisible. Now in order to make it divisible we must add another cipher, but in doing so we must also add a cipher to the quotient.

1005)2250(2.238805
2010

2400
2010

3900
3015

8850
8040

8100
8040

6000
5025

975

There are some cases known as re-

curring decimals, or repeating decimals which occur in division. This means that it is impossible to ever reach an even quotient without a remainder. For instance 100 divided by 3 gives

```
3)100.000000
--------------
  33.333333
```

and so on for ever. In these cases the recurring figure or figures are set down with a small dot on top and this shows that it is repeating.

In the case of a decimal fraction of 4 or more figures, it is quite easy to shorten it without affecting the accuracy to any material extent. Of course, it must be understood, that sometimes accuracy to the seventh place is required, but one can always judge when a statement may be shortened for the sake of simplicity

Take a decimal fraction like .4985. This can be made.5, the error being only .0015, or 15/10,000, which in most cases is negligible. If the fraction were .428 it could be called .43, or if it were .424 it could be called .42.

We have shown that a decimal fraction can be easily converted into a vulgar fraction, and the reverse is always the case. To convert a vulgar fraction into a decimal all that is necessary is to divide the denominator into the numerator. For example to convert ¾ into a decimal we divide 4 into 3, and as we have seen already it will be:—

```
4)30(.75
  28
  --
  20
  20
  --
  ..
```

Convert 3/64 to a decimal

```
64)300(.046875
  256
  ---
  440
  384
  ---
  560
  512
  ---
  480
  448
  ---
  320
  320
  ---
```

We believe that this should cover the necessary ground work to enable the student to understand decimals, and we will take up in our next lesson the square and cube, and their roots.

TRIAL TRIP FROM MIDDLESBROUGH

On Wednesday the 6 July, 1921, the handsome steel screw steamer "MONT VISO" built by Sir Raylton Dixon & Co., at their Cleveland Dockyard, Middlesbrough, to the order of La Societe Generale de Transports Maritimes a Vapeur, Marseilles, proceeded to sea for her official trials.

The vessel has been built to a very complete specification and is of the two-deck type with bridge and poop combined and forecastle, her principal dimensions being 370 ft. by 53 ft. by 28 ft. 6 in. moulded with a deadweight carrying capacity of about 7,800 tons on a light draft of water and she has been constructed under special survey to receive Lloyd's highest classification also to meet the requirements of French Law including fire extinguishing.

Captain's accommodation is provided on the lower bridge with wireless office and room together with chartroom and wheel house above. Saloon house is built at fore end of bridge together with accommodation for Officers and Stewards, while the Engineers are housed at casing side on the port side and the Petty Officers on the starboard side, the crew being berthed under poop aft with entrance house and sanitary arrangements on top. Steam heating is provided in all midship accommodation with heaters to the baths and fresh water condenser is fitted on casing top amidships.

The steamer has 4 large holds with a reserve bunker and 5 large hatches, and she has 2 winches to each main cargo hatch, those at No. 2 being coupled together for heavy lifts. Winch with extended ends is fitted at the reserve bunker. The vessel has 2 telescopic masts and 2 derrick posts at the reserve bunker hatch, each hatch being served by 2 derricks and in addition a 15 tons derrick at No. 2 hatch. Six cargo port doors are fitted for access to the tween decks.

Complete electric light installation is fitted throughout the vessel, also wireless installation by the Compagnie Exploitation Radio Electrique.

Nos. 2, 5 and 6 double bottom tanks are arranged for the carriage of oil fuel as well as 2 oil fuel bunkers in the engine room. Heating pipes and oils are provided for these bunkers and for the oil fuel tanks, steam being taken direct from the boiler tops through reducing valves and distribution chests. Each tank is controlled separately and the exhaust coupled together and lead to observation tank in engine room supplied with the usual fittings.

Triple expansion engines, placed amidships, having cylinders 25 in. 41 in. and 38 in. by 45 in. stroke, supplied with steam by 3 large single-ended boilers working at 180 lbs.pressure have been installed by Messrs. Richardsons' Westgarth & Co., Middlesbrough. The boilers are arranged to burn either coal or oil on the Wallsend-Howden Patent system of oil fuel burning, consisting of 2 sets of pumping and heating plants and 2 transfer pumps of Weir's make for transferring the oil from the bunkers to 2 large settling tanks which are provided with the necessary gauges, drain cocks, filling and discharging valves, thermometer pockets, over flow pipes, air pipes. etc., all to Lloyd's latest requirements.

The trials passed off very satisfactorily and the vessel attained a speed of over 11 knots.

The hull and machinery have been constructed under the superintendence of Commandant A Robillot and the Owners Chief Engineer Monsieur Lombard, with Messrs. C. E. Smith & Son, West Hartlepool, as local Superintendents.

NOTES FROM SOREL

ON Saturday, August 13th, the Jeannon L. was launched at the Transportation and Shipping Co's. Shipyard Sorel, Que.

She is a fine steam barge, 185 feet long, 36 wide and 19 deep. She has three masts for derricks, a donkey engine and boiler, strong windlasses and full equipment for loading and unloading.

This boat is one of six begun by the Leclaire Shipbuilding Company and two of them were finished as straight sailing schooners; the Ninon L, and the Marion L. The Leon L. is a power and sail boat, and the fourth, the Jeannon L is a steam barge.There are two more of these constructions to be launched.

On labor day, September 5th, regattas will be held at Sorel, Que., on the St.-Lawrence River. Many entries have already been received for power boats, canoes, etc. These regattas will be better than any held heretofore at Sorel, and Sorel has a reputation for good regattas. The most elaborate and careful arrangements are being made to accomodate the visitors. Newspapers have already been invited to send their sporting editors and the judges' float will be arranged to accomodate them. Entries will be received by the Commodore, Geo. Beachemin, Sorel, Que., or J. A. St. Arnaud, Secretary, P.O. Box 68, Sorel, Que. Information in connection with the newspaper matters will be cheerfully volunteered by the President of the Press Committee, F. C. Cadoret, P.O. Box 501, Sorel, Que.

Transportation people are interested in the new tug NAPOLEON L which has been sent to Montreal on her maiden trip August 16th. This tug in 135 feet long, 23½ wide and 26½ deep. The tug is steel throughout, and was begun in 1918 as a trawler, but afterwards the construction was discontinued during the adjustment of the Leclaire Shipbuilding Company's affairs which were sold to the Transportation and Shipping Co. The Napoleon L has a tonnage of 96 gross tons. Her engine is a triple expansion, 750 H.P. There is an upper deck for officers and windlesses. The tug is also provided with masts and equipment for wireless telegraphy. The Napoleon L will be used for towing on the St. Lawrence River the Gulf and the sea, and she is one of the finest tugs afloat.

Seattle.—The C.P.R. steamer Princess Ena, which runs between British Columbia ports, went ashore on Godyn Head, according to wireless advices received at this port. The report stated that it was hoped the vessel would refloat in a short time.

*Analysis of Internal Combustion Engines

Electrically Driven Auxiliaries—Two and Four Cycle Engines—Solid Fuel Inspection—Disadvantages of Diesel Electric Drive—Comparative Earning Capacities of Motorship and Oil Burning Steamer—The Motorship William Penn.

AS with the steam engine, there is a limit in size of cylinder for a Diesel engine, and it would appear that a 31½-inch diameter is nearing this limit, due principally to liner thickness required. Considerations of convenience for handling the parts on board ship are also involved. It would seem that the next logical step with the four cycle engine for increasing the power to more than 500 indicated horsepower per cylinder is to resort to the double acting piston. From the standpoint of elimination of heat troubles, the condition is believed to be more favorable for the double acting four cycle engine than for the single acting two cycle engine, as the maximum temperature at the first part of the power strokes is alternately distributed to the two ends instead of continually to one end of the cylinder as with the two cycle.

Electrically Driven Auxiliaries

The adaptability of the motorship in having its auxiliaries electrically driven and the advantages resulting from the same were at the beginning recognized by Burmeister & Wain and incorporated in their first vessel. As the internal combustion engine by nature requires an external source of power for starting and maneuvering, the same power can be effectively used for other purposes as for driving pumps in engine room and deck machinery. The saving in fuel thus made, being about one-tenth that of a steam vessel when in port it should be observed, is due primarily to the efficiency of the Diesel engine driving generators and not so much to the electrical transmission as some have been led to assume.

In the earlier installations two large auxiliary engines were used, each driving a generator and compressor in tandem, the latter being uncoupled when in port. This was soon replaced by three, and now, as in some of the larger vessels, by four, small sets having generators only. The compressors on the main engines at the same time were changed from single to high stage compressors, taking their air from the maneuvering air system to independent three stage compressors. For the two low pressure air compressors, one of which was always operated at sea, was substituted one motor driven compressor for maneuvering purposes only. This latter arrangement is better in that the high and low pressure air systems are not interdependent and the auxiliary power plant is more flexibile. From an operating standpoint it is also better, as, by having more than two sets and being small in size, they can be overhauled in turn at sea, relieving the work of the engineers' personnel in port, whose time should then be given to more important port duties.

Two vs. Four Cycle Engines

The special claims made for the two cycle engine is that more power can be obtained per cubic space of cylinder, from having double the power strokes of a four cycle, and hence less weight and space occupied; also that the two cycle, having no exhaust valves to cause trouble, can burn the lower grade oils of high sulphur content.

The four cycle advocates dispute these claims by saying that the two cycle engine cannot run with as high mean pressures in the cylinders as the four cycle, if internal heat troubles are to be avoided, and that the combustion is not apt to be as complete as in the four cycle. They also point out the lower mechanical efficiency, resulting from negative work required for scavenging, and hence higher fuel consumption. With the rings passing across the open ports wearing conditions are not so good as with the unbroken liner surface of the four cycle, and the cylinder lubricating oil consumption is much higher than the four cycle due principally to the oil being scraped into these ports and blown out through the exhaust. It is also stated that with the long pistons required, scoring is apt to result from misalinement caused from wear at crossheads and guides. The two cycle originally dominated the field of the light high speed submarine engine, but after some ten years have been spent in its development it has been superseded in this field to a great extent by the four cycle. This would not have been possible if there is any inherent advantage in the two cycle as to weight for a given output. Moreover, in the long trade routes, which is the merchant motorship's chosen field, it must be obvious that the conceded superior economy of the four cycle will give an advantage in deadweight cargo capacity more than sufficient to offset the advantage in weight of machinery claimed, but not yet proved by the two cycle advocates.

Some makers, who originally built four cycle engines and changed to two cycle, have in recent years changed back to four cycle, and others, who have always built the four cycle, are known to be experimenting with the two cycle. All experienced builders are fairly well agreed, however, that the Diesel engine works best at low speeds due to the nature of the injection and burning of the oil, and that the large cylinder engines better burn the lower grade oils. Oil of higher sulphur content, though, as commonly used under boilers, is not to be recommended, as the sulphuric acid formed in the burning not only affects adversely the exhaust valves of the four cycle engine but attacks impartially the exhaust pipes and other parts of either the four or two cycle.

Solid Fuel Injection.

The makers have advocated the solid injection or injection of the fuel by pressure alone, with which Vickers has been most successful. The chief difficulties encountered with such a system are in getting good combustion at all running speeds and loads and the eliminating the shock and vibration which is apt to occur with the sudden rise in pressure when fuel is injected. The advantage claimed is that compressor troubles are entirely eliminated with a correspondingly higher mechanical efficiency obtained than with air injection. The fuel consumption, often erratic, however, under the most favorable conditions, is no better than the air injection full Diesel. It is also questioned if an oil pressure from 2,500 to 4,000 pounds per square inch is more to be preferred than an air compressor and its corresponding air system having a pressure of 850 to 900 pounds.

The Diesel electric drive has been suggested by some, using direct current supplied by several high speed engine sets working in series. The sponsors of this system apparently have either taken their cue from the turbine electric drive or are more familiar with the electric end than the shortcomings of the high speed Diesel engines. To reduce the weight of the engines and space occupied sufficiently to compensate for the additional electrical equipment involved, the engines must necessarily be high speed and of the trunk piston type. The engines would correspond in design to that halfway between land and submarine practice.

Disadvantages of Diesel Electric Drive.

The disadvantages of such a system compared with the direct drive are as follows:

1. Loss in reliability in the prime movers.
2. More major overhauls, as lifting of cylinder covers and drawing of pistons, due to poorer combustion and passage of lubricating oil from crank case.
3. About 30 per cent more fuel per knot, 15 per cent. chargeable to higher fuel consumption of engines and at least

*From a paper read before the Society of Naval Architects and Marine Engineers, New York, May 26.

15 per cent. electrical losses with the small size generators used.

4. Lighter grade and more expensive fuel oil required.

5. Much higher lubricating oil consumption associated with high speed and trunk pistons.

6. Possible vibration troubles associated with high revolutions.

7. Necessity for using objectionably large motors of the commutator type for transmissions of power from engines to propellers.

8. Greater complication of controls and more expert knowledge required of the engineer personnel.

9. Tendency to overwork the personnel with the frequent overhauls required with high speed engines when operated continuously at full power.

10. Danger of short circuits.

11. Short life of high speed engines compared with slow speed engines.

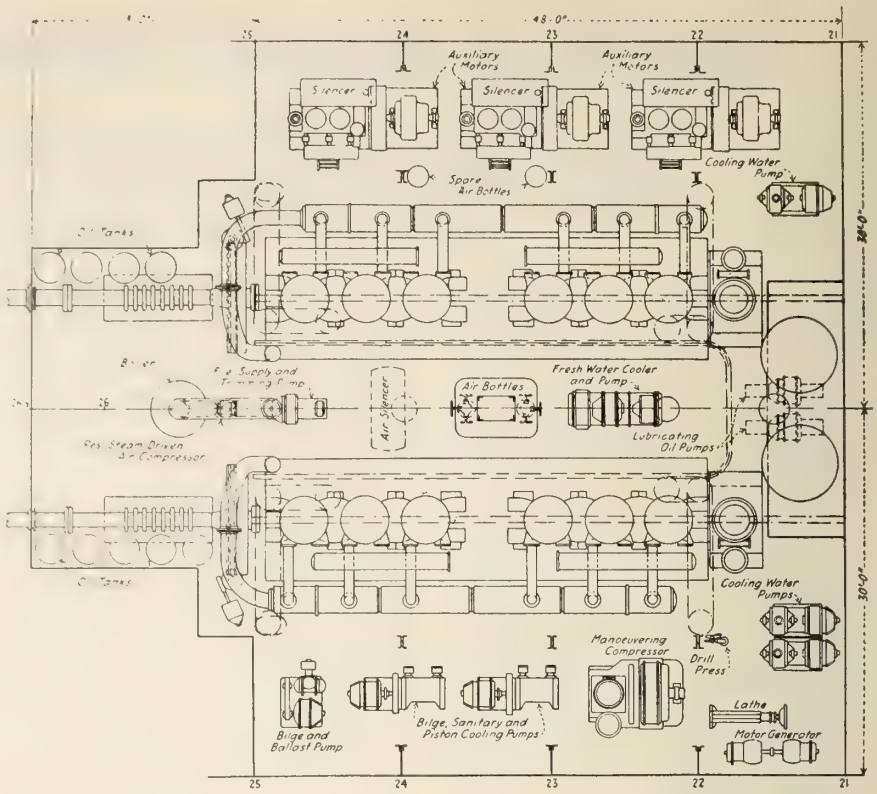
12. Higher first cost and maintenance charges.

With the higher consumption of fuel and lubricating oil per indicated horsepower combined with the electrical losses involved and the better quality of fuel oil required, the total expenditure for these items will be about 50 per cent more than with the direct drive system.

The Diesel electrical system has been specially recommended for converting existing steamers. It is believed by the authors that this can be far better accomplished by using a long stroke engine turning at the low revolutions required. Work has been done along these lines by Doxford and Cammell-Laird, using the doubled opposed piston, and also Burmeister & Wain have developed a line of long stroke engines, with a stroke bore ratio of two to one, specially adapted to single screw vessels. These latter engines are to be recommended for new vessels, as well, of 5,000 tons deadweight and less, on account of less engineroom personnel required, important in small vessels, and the dispensing with one shaft alley, which is also important in this size ship.

For new motorship construction, over 5,000 tons deadweight, two screws are to be recommended. In smaller vessels there is little difference in propulsive efficiency between single and twin screws. For larger ships, however, the efficiency is more favorable with the two shaft arrangement due to well known conditions affecting propeller performance, including the better immersion of the two smaller propellers under all conditions of draft. In the larger vessels, also, the saving in space by having only one shaft alley is not so important, and the length of engineroom will be less with the higher speed standard stroke engines.

A comparison will be given showing the estimated increased earning capacity of a motorship over a corresponding oil burning steamer as can be anticipated in actual service. The size of vessel chosen has the same general dimensions as the motorship Afrika, owned by the East Asiatic Company, and which is similar to the William Penn and the two motorships building for the United American Lines.



Comparative Earning Capacities of Motorship and Oil Burning Steamer.

The steamer is single crew with double reduction gearing and compound turbines and Scotch boilers. The revolutions for the vessel are taken as seventy, which is conservative practice, to favor propulsive efficiency which for convenience here is assumed the same as the twin screw vessel.

The ships are of the awning deck type having a nominal deadweight carrying capacity of 13,000 tons when loaded to 31 feet 5 inches draft. They are 445 feet between perpendiculars, 60 feet beam and 42 feet molded depth, with a block coefficient of 0.782. The shaft horsepower of the turbines is taken as 3,500 which is equivalent to the 4,500 indicated horsepower of the Diesel engines. The cost of the vessels to build, based on probable cost of labor and material in the immediate future, is assumed $150 per ton for the steamer and $165 for the motorship. The $200,000 additional cost of machinery for the motorship, including deck machinery, is considered fair where the Diesel work is well standarized.

The fuel oil consumption at sea for the steamer with 16 degrees Baume oil is taken as 0.95 pound per shaft horsepower, all purposes, which should be realized in service with properly designed turbines and double reduction gears and co-ordination of auxiliaries. For the motorship, with oil of 22 degrees Baume, the consumption is taken as 0.31 pound per indicated horsepower all purposes, which is usual with motorships belonging to the East Asiatic Company. The cost of oil in American port, per recent quotations, is $2 for fuel oil for steamer and $2.30 for Diesel oil of gravity indicated. It is necessary for the steamer to take on additional oil in a foreign port which is assumed double that in an American port.

The route chosen is from San Francisco to the Far East and return, calling, for example, at Yokohama, Hong Kong, Manila and Honolulu, with a total distance of 15,500 knots. The number of days at sea and in port is taken from percentages for similar vessels operating over similar routes, and the number of days in port include that for loading and unloading, repairs and docking, holidays, etc.

The cost of personnel is based on the scale of wages in effect the first part of this year with sustenance at $1.25 per man. This is estimated with 27 for the deck officers and crew for either vessel, and for the engine room 19 and 14 men respectively for the steamer and motorship.

The freight rate for bulk cargo is estimated as $27 per 100 cubic feet and for deadweight cargo as $13.50 per ton, which is fairly well in accordance with present rates.

From the foregoing it will be seen, for the particular conditions chosen, that the motorship has an increased earning capacity over the steam vessel of 66 per cent. on deadweight and 55 per cent. when bulk cargo is carried. In addition to the bulk cargo, there can be carried on the outbound trip 544 tons of oil, which, at $13.50 per ton, will increase the amount earned on investment from 17.4 per cent. to 18.73 per cent. or 67 per cent. better than the steamer.

The above figures can be used as a basis for working out a comparison for any route which will vary directly with length of voyage and the size of the vessels employed.

The Motorship William Penn.

A brief description of the motorship William Penn will be given, as it was the first large vessel of this kind owned by the United States Shipping Board. The performance of this vessel in service will be of particular interest, as it is to be operated over the same route and by the same operating company as the electrically driven ship Eclipse, recently put into service.

The hull, having been originally intended for a 3,000 shaft horsepower single screw turbine installation, is not exactly suitable to the Diesel engine installation of 4,500 indicated horsepower, or 3,500 shaft horsepower. For best efficiency, due to its high block coefficient, the vessel should not be driven over 10½ to 11 knots in service. The screws have accordingly been designed for lower turns than that for which the engines were intended, so that the designed mean indicated pressure, upon which the efficiency of engines somewhat depends, will be maintained.

The William Penn has a length between perpendiculars of 439 feet 6 inches, a beam of 60 feet, a depth molded to shelter deck of 36 feet 8 inches, and a draft of 28 feet 4¾ inches, corresponding to 12,375 tons deadweight. The length of engine room space was maintained the same as for the steam driven sister ships. A built-up column was added to tie the middle of the engine room double bottom to the shelter and bridge decks, to prevent possible synchronous vibrations being set up between the main engines and the hull's structure.

The main engines are, as previously stated, six cylinders, each of a bore and stroke of 740 millimeters and 1,150 millimeters, respectively. Along the port side are arranged the three auxiliary engines each driving 65 kilowatt generators, and along the starboard side the maneuvering compressor and bilge and ballast pumps. The lubricating and salt water cooling pumps are placed near the forward bulkhead and the fuel oil pump and reserve air compressor aft, between the main engines. In this vessel a fresh water closed cooling system, with cooler and fresh water pump, has been added for the cooling of the cylinders and covers. This is a precaution against mud being deposited in the spaces, which is liable to occur with deep draft vessels when navigating shallow waters and rivers. The salt cooling water is maintained for the main compressors and piston cooling, which is also used for cooling the fresh water.

BRITISH TURBO-ELECTRIC LOCOMOTIVE

Great secrecy is being observed regarding the turbo-electric locomotive which a leading British engineering firm is building for trial on a main line British railway. It can, however, be stated that the principle adopted is similar to the system of electric ship propulsion which was first patented in Great Britain. The prime mover is a high speed turbine coupled direct to an electric generator; this generator supplies current through controllers to motors which drive the wheels through some form of gearing. The advantage of this arangement is that it combines the great efficiency of the high-speed turbine with the flexibility of electric speed control. If the trails are successful they will probably lead to the conversion of many express steam locomotives to the electric drive. This turbo-electric locomotive is not to be confounded with a new type of "thermo-electric locomotive which another leading British firm is building for experimental purposes. In this case the prime mover is an internal combustion engine of a novel and economical design, which can utilise any kind of crude oil. In countries overseas where there is a deficient water supply along the routes of railways there is a magnificent field for an internal combustion engine locomotive which proves to be really efficient.

GREAT NEW DOCK ON THE THAMES

Th extension recently completed to the Royal Albert Dock on the Thames forms the most costly single work ever undertaken to improve the facilities of the Port of London. Over four and a half millions were spent on the extension, which adds a water area of about 64 acres and provides about two and a half more miles of quay. Construction was begun in the year 1912 and was maintained (though of course on a limited scale) throughout the war. The working depth in the dock is 38 feet so that the largest class of vessel using the port can be accommodated. A prominent feature of the dock is a double bascule bridge carrying a roadway. Each leaf weighs 368 tons and the bridge opens in sixty seconds. An elaborate equipment of electric cranes has been provided, together with every facility for the rapid loading and unloading of vessels. Since its opening by the King and Queen this dock is known as the King George V. Dock.

IMPROVING BRITISH LIFE BOAT SERVICE

Excellent results have been obtained by the British life boat service in the use of tractors in place of horses to launch the boats, but this is only one of several recent improvements. Many experiments have been made recently with mechanical devices for effecting communication between the life boat and the ship in distress. These experiments have lead to the adoption of a special line-throwing gun invented and made by a leading British firm. The gun is able to throw a half inch line from 60 to 80 yards in all conditions of weather. The line is coiled in a tin cylinder which fits over the barrel and the end is fixed to a hollow steel projectile fired from the gun with a cordite cartridge. The whole contrivance is so light that it is not much heavier than a service rifle and can be fired from the shoulder with only a slight recoil. It is expected that this invention will lead to the saving of many lives under circumstances when the lifeboat cannot approach the ship closely enough for a line to be thrown.

THE IDEAL RUDDER

The "reversing rudder" which was invented some little time ago in Great Britain continues to meet with remarkable success. About a year ago the Norwegian Hydrographic Office ordered one for trial on a motor survey launch and the results have been so highly satisfactory that the Department has decided to make the rudders a standard equipment on all the boats, These rudders consist of curved pieces of metal, one on each side of the propeller; and by moving these pieces relatively to each other and to the propeller all the evolutions of steering and reversing can be carried out with unexampled rapidity and ease. As the reversing is done while the propeller continues to "go ahead", the equipment is admirable for motor-driven launches.

BRITAIN'S LATEST AEROPLANE

The latest type of British passenger-carrying aeroplane has an enclosed cabin for eight passengers and an open cockpit for the pilot and mechanic. It is a biplane driven by a single engine of 450 horse power. The seats are made collapsible so that practically the whole of the cabin space may be used for cargo if desired. An interesting detail is that for the benefit of passengers liable to air sickness a small concealed self-emptying basin is provided close to each seat. Windows to open are fitted on the full length of each side of the cabin, and heating is provided by hot air muffs round the exhaust pipes. The pilot's cockpit is fitted with a complete wireless telephone and telegraph installation. This machine when fully loaded, takes 9 minutes to climb to 5,000 feet, at which height its speed is 118 miles per hour. Fuel and oil sufficient for a journey of 400 miles are carried on board.

Montreal.—The port of Montreal is not reflecting any of the depression that exists generally in the shipping world, there having been on one day this month no less than 52 ocean going ships loading and discharging in the harbour. Besides these there were a number of lake vessels. The great activity this season is attributed to the amount of grain cargoes being shipped to the U.K. and Continent from Montreal.

FURTHER augmenting its Pacific fleet and strengthening itself against the competition of Japanese and American lines, the Canadian Pacific Ocean Services, Ltd., have acquired the former German liner Tirpitz, which was completed in Germany during the war. The Tirpitz is a vessel of 19,300 tons. She will be renamed the Empress of China. This will necessitate the re-naming of the Prinz Friederich Wilhelm which was to become known as the Empress of China, but which is to be retained for service on the Atlantic while the Mauretania is being repaired.

* * *

There has not been much talk lately about Japanese plans for shipping expansion, but United States lines, especially the Pacific Shipping Company, continues to operate extensively. The Pacific Steamship Company has undertaken to operate a number of big Shipping Board vessels in the trans-Pacific trade. The maiden trip of the liner Wanatchee was crowded with misfortune. She had much trouble while in the Orient, and it is expected that $100,000 must be spent in getting her in condition again. She is now tied up at Seattle.

* * *

The Furness, Withy Steamship Company, after making extensive inquiries, has decided to assign four vessels to service between the United Kingdom and Pacific coast ports. Frank Waterhouse & Company have been appointed agents in the North Pacific. Among the ships to be operated are the Mongolian Prince, Eastern Prince, Siberian Prince and El Cordobe. They are freighters and average 9,000 deadweight tons. Others will follow.

* * *

Still awaiting definite word from the Federal Government as to the steps that are to be taken to reorganize and finance the Victoria Shipowners (B. C.), Ltd., shareholders of that concern are growing uneasy in the thought that their equity may be annulled, thus causing a total loss of the investments. The Victoria Shipowners started out in 1920 as a co-operative ship-owning concern, the general public being asked to subscribe, while the Federal Government agreed to advance 70 per cent of the capital in the form of loans. The company undertook to build four wooden barquentines for the lumber trade, the Cholberg Shipyards, Victoria, receiving the contract. Costs proved much higher than the estimate and work was stopped. The Government was called in to straighten out the company's finances and finally it took complete charge. A group of shareholders have now passed a resolution declaring that the cause of failure was the insistence of the government that 60 per cent of the shipyard employees should be returned soldiers. They hold that this caused inefficient work. They contend that the shareholders of the Victoria Shipowners are entitled to the same treatment as that accorded the creditors of the Prince Rupert shipbuilding company, and they urge that the government make an immediate statement as to its future policy. This statement is now being awaited.

* * *

The Hudson's Bay Company Arctic trading steamer Lady Kindersley, now on her maiden voyage into polar waters, has been libelled at Juneau, Alaska, for colliding with the barge Palmyra while the barge was being towed by the tug Richard Holyoke, near Whale Island. The complaint alleges that the Lady Kindersley paid no attention to frequent whistle signals. The Pacific Coast Gypsum Company, of Tacoma, has filed the libel charges, and it also sues the Hudson's Bay Company for loss of time caused in the mines by the laying up of the barge.

* * *

The steamship Loyalty, once famous on the Pacific as the Canadian Pacific liner Empress of India, is now tied up at Bombay and her fate is uncertain, according to advices received from the Orient. The Loyalty was sold during the early months of the war to an Indian rajah, who operated the vessel as a hospital ship for the British Government. After the war the ship was sold to an Indian shipping company, but she has been idle for months owing to inability to obtain a surveyor's certificate. The Canadian Pacific Ocean Services originally operated three sister ships between Japan and China and British Columbia, the Empresses of Japan, China and India. The China was wrecked in Yokohama harbor about five years ago. The Japan is still in operation.

* * *

On her official speed trials on the Clyde the Canadian Pacific Ocean Services liner Empress of Canada, to be placed in the trans-Pacific service shortly, maintained a speed of 25.6 knots an hour. The Empress of Canada was built by the Fairfield Shipbuilding Company and is now being prepared for her maiden voyage, which will be made via the Suez Canal. Twenty-five knots is the fastest speed ever attained by a trans-Pacific liner, the present record being held by the C. P. O. S. liners Empress of Russia and Empress of Asia, who make about 21 knots.

* * *

Steamship companies transporting copper from British Columbia ports are feeling the effects of the recent cut in trans-continental rail rates, especially those from the Utah mines to Baltimore. The most recent cut was $6 a ton, making the present rate $15. The railways also grant the privilege of "refining in transit" for one dollar more, and this cannot be done on the steamships.

The Canadian Government Mercantile Marine steamship Canadian Exporter ran aground on Willapa Spit on the Washington coast July 31 and has been abandoned as a total loss. The vessel was completely broken in two. The crew was saved.

* * *

Claiming the wages they were receiving were below the Pacific standard, nine men of the crew of the Canadian Government Mercantile Marine steamship Canadian Rover struck while she was loading pulp and paper at Ocean Falls, B.C., a few days ago, and refused to go to sea. According to B. C. Keeley, manager on this coast for the C.G.M.M., the men merely wanted a holiday after three months at sea. He does not anticipate further trouble, although strike breakers have been sent to Ocean Falls.

* * *

The Royal Albert bronze medal was presented to Aaron E. Higgins in Vancouver recently by Lieut.-Governor Walter C. Nichol in recognition of gallant conduct on August 27, 1919, when an explosion occurred on the steamship Melville Dollar, of the Canadian Robert Dollar Company. Higgins was third engineer of the steamship.

* * *

Opening up a trade which is likely to reach vast proportions, the Holland-Amerika liner Kinderdijk will load 5,000 carcases of Alberta mutton while in British Columbia for transport to Europe by the Panama Canal. In the past all chilled meat has been carried via the Atlantic. Cured pork is also likely to figure heavily in future shipments.

Some Interesting Statistics of Shipping

The Figures and Notes Here Given Have Been Compiled From The New Registry Book of Lloyds by "Lloyd's List" and Shed a Very Interesting Light on Present Conditions

THE NEW edition of Lloyd's Register Book, which is now in the hands of subscribers, records the particulars of 4773 sailing vessels, aggregating 3,128,328 tons, and 28,433 steamers, aggregating 58,846,325 tons. In addition to this indispensable list of the world's sea-going ships of over 100 tons, the latter part of Volume I. and the whole of Volume III. are devoted to miscellaneous information which will be of every-day use in all shipping offices.

The section which is of the greatest immediate interest is that containing the Statistical Tables. The world-wide confidence which is felt in the work of Lloyd's Register is demonstrated by the fact that more than twenty-eight and a quarter million tons of shipping are now classed or about to be classed by the Society, over fifteen and a half million tons of which are owned abroad. Of the total steel and iron sea-going merchant tonnage now in existence, 65 per cent. has been built under the survey of Lloyd's Register, and the new vessels classed during the calendar year 1920 reached the huge total of 3,632,225 tons.

The principal table is of great value as showing how the several countries are recovering from the war period, and it will be of interest to analyze the figures and compare them with those contained in the corresponding tables issued in previous years.

The reduction in sailing tonnage since pre-war time, say June, 1914, amounts to 852,000 tons, which is a much smaller decrease than any that occurred in the previous period of seven years. This is principally due to the increase which has taken place in the United States, the only country which has added to its sailing tonnage since 1914, apart from any ex-German tonnage allocated. Nearly 41 per cent. of the world's tonnage is now owned in the United States. It should, however, be remembered that the figures for that country include a large proportion of sailing barges. The other countries which still have a considerable amount of sailing tonnage are the British Empire (482,000 tons), France (353,000 tons), Norway (213,000 tons), and Italy (183,000 tons).

The percentage of sailing vessels to the world's tonnage is now 5 per cent., as compared with 8 per cent. in 1914, and nearly 22 per cent. in 1902, and in view of this small percentage it will no doubt be more convenient if sailing vessels be excluded from consideration in dealing with the present relative position of the various countries.

Sea-Going Steamers

The tonnage of wood vessels owned in 1914 amounted to 1 per cent. of the total steam tonnage, whereas for the present year that percentage has risen to 3.9 per cent. This is, of course, one of the effects of the shortage of tonnage during the war, which resulted in the construction of a large number of wood vessels. Whereas in 1914 the wood sea-going tonnage owned in the United States amounted to 210,000 tons, the corresponding figure is now no less than 1,210,000 tons. Wood vessels, however, are not of great importance in international trade, and for the purposes of comparison it would perhaps be more accurate if they were excluded. For this reason, in the following figures, which show (in thousands, 000's being omitted) the steam tonnage owned by the principal maritime countries, now and seven years ago, only steel and iron sea-going vessels are included.

Country	June, 1914	June 1921	Difference between 1921 & 1914
	Tonsgross	Tonsgross	Tonsgross
United Kingdom	18,877	19,288	−411
British Dominions	1,407	1,950	+543
America (U.S.)	1,837	12,314	+10,477
Austria-Hungary	1,052	....	....
Denmark	768	866	+98
France	1,918	3,046	+1,128
Germany	5,098	654	—4,444
Greece	820	576	—244
Holland	1,471	2,207	+736
Italy	1,428	2,378	+950
Japan	1,642	3,063	+1,421
Norway	1,923	2,285	−362
Spain	883	1,094	+211
Sweden	992	1,037	+45
Total abroad	23,637	54,217	+11,292
World's total	42,514	54,217	+11,703

It will be seen that among the principal countries, apart from Germany, Greece is the only one which still shows a reduction in the tonnage now owned as compared with 1914. Notwithstanding the increased construction and the large amount of ex-enemy tonnage allocated to British ownership, and, of course, included in the figures, there are at the present time only 411,000 tons more owned in the United Kingdom than in 1914.

The sea-going tonnage of the United States has increased by nearly ten and a half million tons, an increase of 570 per cent. on the 1914 figures. The other countries in which the largest increases are recorded are: Japan (1,421,000 tons), France (1,128,000 tons), Italy (950,000 tons), and Holland (736,000 tons). As in the case of the United Kingdom, the figures for France and Italy include a considerable amount of ex-enemy tonnage allocated to these countries. The figures for Germany conclusively show the change in the maritime position of that country. While in 1914 Germany ranked next to the United Kingdom with over 5,000,000 tons of sea-going steel and iron steamers, her total tonnage now stands at only 654,000 tons.

The United States percentage of the world's sea-going steel and iron steam tonnage has increased from 4.3 in 1914 to 22.7 in 1921. The relative position of some other countries has also altered to a large extent. In 1914 the United Kingdom owned nearly 44½ per cent. of the world's sea-going steam tonnage; the present percentage is just over 35½ Norway, which occupied the third place, is now sixth, while Japan, which was sixth, is now third, closely followed by France with only 17,000 tons less. Taken together, the Scandinavian countries—Norway, Sweden and Denmark—show an increase, as compared with 1914, of 505,000 tons.

Summarizing the totals it will be seen that the present position of the sea-going merchant steel and iron steam tonnage as compared with 1914, is as follows:

Increase in the United Kingdom	411,000
Increase in the United States	10,477,000
Increase in other countries	6,311,000
	17,199,000
Loss to Germany	4,444,000
Ex-Austro-Hungarian Tonnage	1,052,000
	5,496,000
Net World's Increase	11,703,000

It should be stated, however, that table No. 1 includes under "Flag not recorded," some 373,000 tons of ex-German vessels of 1600 tons and above, the allocation of which was not known at the time of going to press, and to that extent the figures for some of the Allied countries will be increased in the near future.

Size and Type of Vessels.

In 1914 there were 3668 sea-going steamers each of 4000 tons and above; there are now 5209. The greatest increase has taken place in those of between 6000 and 10,000 tons, their number having increased from 1904 in 1914 to 1784 in 1921.

The following table shows the relative position of the principal maritime countries, as regards the number of large vessels and also the progress during the last seven years:

Flag		4,000 and under 6,000	6,000 and under 10,000	10,000 and under 15,000	15,000 and above	Total
British	1914	1,283	462	111	27	1,883
	1921	1,299	705	135	47	2,186
United States	1914	82	50	10	1	143
	1921	770	609	56	14	1,449
Dutch	1914	62	42	5	3	112
	1921	84	100	6	4	194
French	1914	103	52	12	2	169
	1921	161	88	17	3	269
Italian	1914	80	27	—	—	107
	1921	184	66	6	4	260
Japanese	1914	61	43	7	—	111
	1921	183	85	8	—	275
Norwegian	1914	58	12	2	—	72
	1921	109	35	2	—	146
Others	1914	703	316	31	21	1,071
	1921	322	96	9	2	329
Grand total	1914	2,432	1,004	178	54	3,668
	1921	3,112	1,784	239	74	5,209

Among "others" are included German vessels and a number of ex-German vessels not yet allocated to Allied countries.

A careful analysis of the vessels entered in the special lists included in Lloyd's Register Book brings forth some very interesting points. Whereas in 1914 there were in existence 385 steamers for the carriage of petroleum in bulk with a total tonnage of 1,479,000 tons, the present book includes 861 steam and motor vessels of 4,419,000 tons for that trade, an increase of 200 per cent. in the tonnage. If the smaller vessels were excluded, say, those of under 2,000 tons, which are mostly used for local trade, the average of the other 731 would reach 5875 tons each. Included in the total are 55 vessels of between 8000 and 10,000 tons and 37 of over 10,000 tons each. The number of vessels fitted with internal combustion engines has increased enormously since 1914. At that date 200 such vessels of 234,000 tons were recorded in the Register Book, and now the total figures are 1447 of 1,263,000 tons.

A great development has also taken place as regards the use of liquid fuel on board steamers. In 1914 there were 364 steamers of 1,310,000 tons fitted for burning oil fuel, whereas the present Register Book includes no fewer than 2536 such vessels of 12,797,000 tons, which tonnage is more than nine times larger than that of 1914. The following interesting comparison, expressed in percentages of total gross tonnage, between the two years may be noted as regards the division of motive power:

	1914.	1921.
Sail power only	7.95	5.05
Oil, etc., in internal combustion engines	0.47	2.0
Oil fuel for boilers	2.62	20.65
Coal	88.96	72.30
	100.00	100.00

It will thus be seen that only 72 per cent. of the tonnage of the Merchant Marine now requires coal, while in 1914 the percentage was 89. Another point of interest indicating the change which is taking place in the method of marine propulsion is the fact that the new Register Book includes some 1100 vessels fitted with both sails and auxiliary engine power; of this total 740 have motors and are, of course, included in the total mentioned above of 1447 vessels fitted with internal combustion engines.

SWEEPING THE SEAS.

It is certain that the world at large does not realize what an enormous and difficult task it was to clear the seas of mines after the conclusion of the war. Round the British coasts alone 75,000 mines had been laid as a submarine barrier; and that area represented no more than a fraction of the total where mines had been sown freely. The British forces engaged in this work of clearance have swept an area about equal to the whole of England and Wales; the work was done thoroughly but with so much scientific care for the men employed that the loss of life has been less than one per cent of the number of hands engaged. In this beneficient kind of "sweeping the seas" Great Britain has proved as efficient as in the warlike form for which the Navy has ever been renowned.

Lloyd's Register Shipbuilding Returns

for the Quarter ended 30th June, 1921

MERCHANT VESSELS UNDER CONSTRUCTION

Warships are not included in these returns. Complete totals for Germany are not yet available, therefore no figures are shown for that country.

The returns compiled by Lloyd's Register of Shipping, which only take into account vessels of 100 gross tons and upwards, the construction of which has actually been commenced, show that there were 789 merchant vessels of 3,530,047 tons gross under construction in the U. K. at the close of the quarter ending June 30 1921. The particulars of the vessels in question are as follows, similar details being given for the previous quarter, and for June 30 1920, for the purpose of comparison.

	June 1921 No.	Gross Tonnage	No.	Gross Tonnage	30th June, 1920. No.	Gross Tonnage
Steam:—						
Steel	711	3,282,738	790	3,528,190		
Ferro-Concrete	..	.....	...	.....		
Wood and Composite	4	2,174	4	2,174		
Total	715	3,284,912	794	3,530,364		
Motor:—					895	3,565,910
Steel	73	240,198	60	260,731		
[illegible]	2	600	4	2,094		
Wood and Composite	1	205	2	355		
Total	76	241,003	66	263,180		
Sail:—						
[illegible]	16	3,832	23	4,749		
[illegible]	..	.....	..	.....		
Wood and Composite	1	300	1	300	16	12,243
Total	17	4,132	24	5,049		
Total Steam, Motor & Sail	789	3,530,047	884	3,728,593	941	3,578,153

VESSELS COMMENCED AND LAUNCHED DURING QUARTER

During Quarter ended 30th June, 1921	Steam. No.	Gross Ton.	Motor. No.	Gross Ton.	Sail No.	Gross Ton.
Vessels commenced	17	65,195	2	29,050	4	883
Vessels launched	91	313,103	3	7,505	6	1,082

TOTAL TONNAGE FOR THE WORLD

	Steam. No.	Gross Ton.	Motor No.	Gross Ton.	Sail No.	Gross Ton.	Total. No.	Gross Tonnage
[illegible]	715	3,284,912	57	241,003	17	4,132	789	3,530,047
[illegible]	694	2,373,697	126	261,941	122	53,789	851	2,669,421
[illegible]	2,[illegible]	2,[illegible],609	149	502,944	139	57,921	1,640	6,199,468

*Excluding Germany, figures for which country are not yet available.

DETAILS OF VESSELS UNDER CONSTRUCTION

Gross Tonnage	Number Steam	Motor	Sail
*100 and under 500 tons	88	17	17
500 " 1,000 tons	92	..	..
1,000 " 2,000 tons	77	6	..
2,000 " 3,000 tons	55	1	..
3,000 " 4,000 tons	62	3	..
4,000 " 5,000 tons	42	2	..
5,000 " 6,000 tons	80	4	..
6,000 " 8,000 tons	108	16	..
8,000 " 10,000 tons	48	8	..
10,000 " 12,000 tons	6	..	..
12,000 " 15,000 tons	27	..	..
15,000 " 20,000 tons	24	..	..
20,000 " 25,000 tons	5	..	..
25,000 " 30,000 tons	1	..	..
30,000 " 40,000 tons	..	..	..
Total	715	57	17
40,000 tons and above	..	..	..

*Vessels of less than 100 tons are not included in Lloyd's Register Shipbuilding Returns.

VESSELS UNDER CONSTRUCTION FOR ABROAD

Country for which intended	No.	Gross Tonnage
Argentine	7	9,145
British Dominions	24	90,050
Belgium	5	17,060
Chili	4	18,400
Denmark	8	29,295
France	49	253,883
Greece	3	14,820
Holland	22	189,916
Italy	4	58,500
Japan	4	25,200
Norway	55	261,663
Roumania	1	3,550
Spain	12	37,700
Sweden	1	5,170
United States	3	24,400
Total	202	978,752

MERCHANT VESSELS UNDER CONSTRUCTION ABROAD

	Steam. Steel. No.	Steam. Steel. Gross Ton.	Steam. Wood... No.	Steam. Wood... Gross Ton.	Motor Vessels. Steel. No.	Motor Vessels. Steel. Gross Ton.	Motor Vessels. Wood. No.	Motor Vessels. Wood. Gross Ton.	Sailing Vessels Steel. No.	Sailing Vessels Steel. Gross Ton.	Sailing Vessels Wood. No.	Sailing Vessels Wood. Gross Ton.	Total No.	Total Gross Ton.
United States:—														
Atlantic Coast	58	469,364	..	....	4	24,039	..	....	2	1,600	2	5,600		
Gulf Ports	10	44,741	..	....	..	.....	..	....	..	....	..	....	— 102	717,624
Pacific Coast	22	164,200	..	....	1	3,800	1	2,200	..	....	..	....		
Great Lakes	...	.....	..	....	2	2,080	..	....	..	....	..	....		
British Dominions:—														
Canada—Great Lakes	2	4,803	..	....	..	.....	..	....	..	....	..	....		
Coast	23	81,870	1	140	1	359	..	....	..	....	6	6,960		
Australia	8	26 659	1	140	..	.....	..	....	..	....	2	3,580	62	177,912
Hong-Kong	11	49,500	..	....	1	150	..	....	2	910	..	....		
Others	2	2,500	1	200	..	.....	..	....	..	....	1	150		
Belgium	7	23,165	..	....	..	.....	..	....	..	....	..	....	7	23,165
Brazil	1	2,170	..	....	..	.....	..	....	..	....	..	....	1	2,170
China	7	24,698	..	....	..	.....	..	....	..	....	..	....	7	24,698
Denmark	26	45,700	..	....	16	63,260	1	450	..	....	..	....	43	109,410
Esthonia	...	.....	..	....	3	1,200	2	405	..	....	14	8,585	19	5,190
Finland	7	5,819	..	....	..	.....	4	1,305	..	....	3	980	14	8,104
France	92	374,178	..	....	2	8,400	..	....	8	7,285	3	590	105	390,453
Holland	137	371,684	..	....	..	.....	1	600	..	....	..	....	2	1,500
Greece	1	900	..	2,470	11	17,505	..	....	7	2,200	..	....	155	391,389
Italy	51	250,629	5	2,470	8	37,706	32	10,740	..	....	32	8,788	128	310,333
Japan	45	229.262	..	....	..	.....	..	....	..	....	..	....	45	229,262
Norway	55			201.663	5	19.490	7	1,486	2	475	..	....	59	85,374
Portugal	...	.....	4	1,523	..	.....	6	4,700	..	....	30	9,000	40	15,223
Spain	17	79,917	..	....	..	.....	..	....	..	....	1	150	18	80,067
Sweden	19	33,536	..	....	16	61,095	2	980	1	661	6	1,275	44	97,547
Total	591	2,349.218 (a)	12	4,473	70	239,075 (b)	56	22,866	22	13.131 (c)	100	40,658	851	2,669,421

(a) including 1 ferro-concrete vessel of 475 tons.
(b) including 1 ferro-concrete vessel of 2,000 tons.
(c) including 5 ferro-concrete vessels of 5,000 tons.

At the end of June there were under construction abroad 79 steamers and motor vessels of 1,000 tons and above, with a total tonnage of 565,598 tons, intended to carry oil in bulk. Of these vessels 48 of 388,868 tons were building in the United States of America, and 8 of 58,980 tons in France.

MARINE NEWS FROM EVERY SOURCE

Coming incognito, Prince Axel of Denmark, cousin of King George and of King Christian of Denmark, will arrive in these waters August 22 as master of the big motorship Asia of the East Asiatic Company.

* * *

British Columbia ports continue to be benefited by the operation of steamships through the Panama Canals. The Harrison Direct Line is in full operation again and its vessels, the Author and Collegian, are now on their way out from the United Kingdom.

* * *

The Compagnie Generale Trans-Atlantique has completed plans for the operation of a steamship service between Havre, Bordeaux, Antwerp and San Francisco, Puget Sound and British Columbia ports. The French line operates vessels of 8,000 and 10,000 tons

* * *

A direct passenger service between British Columbia and Europe was inaugurated by the Royal Mail Steam Packet Company with the new 15,000 ton motorship Somersetshire, first of a fleet of motorships, which arrived on the coast August 1.

* * *

The Canadian Puget Sound Lumber Company, of Victoria, has been awarded the contract for the supply of lumber to be used in the construction of the big dry dock at Esquimalt. A large quantity of the timber will be of unusually large dimensions and some 18 by 18 sticks have been specified in the order.

A directional wireless station to work in conjunction with the Pacific Coast chain of American stations is to be established shortly on the British Columbia coast, according to G. J. Desbarats, of Ottawa, deputy minister of the Canadian naval service, who visited Victoria recently.

* * *

The hull of the Canadian Pacific steamer Islander, wrecked twenty years ago in 300 feet of water in the centre of Stephens Passage, Alaska, was examined recently by Capt. Frank Waters, deep sea diver, with a view to salvaging some of the gold said to have been locked up on the vessel when she went down. Capt. Waters states that the shifting of the sand has made recovery of the gold impossible.

* * *

Toronto.—Statistics for the year of 1920 covering the shipping in this port are now available, the season lasting from March to December. The arrivals and departures over this period were 4664, an increase of 1050 over those of the previous year, and the gross tonnage represented was as follows:—Steamships, 4,346,030 tons; propeller and tug boats 828,673 tons; sail and tow barges 261,216 tons; total 5,453,-919 tons.

* * *

Vancouver.—Captain S. Snoddy, of the illfated steamer "Anyox", on his arrival at Vancouver, stated that many more lives might have been saved had the life belts been of a different pattern say of the kind used in B.C. The belts were so made or so fitted by the wearers that when they became exhausted their heads fell into the water, and they were drowned.

Windsor:—The death is reported from Jacksonville Fla. of Capt. Henry L. Innes, for many years a resident of Windsor. Capt Innes was well known in shipping circles of the Lakes, having been connected with this business from early youth. Starting as a boy he early became an officer and later was master of the "John Owne" from which position he became assistant superintendent of the Michigan Central car ferries. He was interested in the automobile business in later life, and at his death was president and General Manager of the American Motors Export Co., of Jacksonville Fla.

* * *

MAKING WOOD FIREPROOF

Some recent technical notes from the Forest Products Laboratory state that progress has been made in the preparation of fire retarding paints as the most practical means of making small amounts of wood somewhat fire resistant. Older methods of impregnating the wood with chemicals under pressure or means of keeping it moist are usually too expensive for small projects although they are more effective. Ordinary white wash or calsomine has proved to be as satisfactory as any other type of paint. A coat of calsomine will not prevent the burning of the wood if exposed continuously to great heat but it does materially decrease the danger of a blaze spreading from sparks, cigarettes, and other small sources of fire. Calsomine is naturally best suited to inside uses. For outside work the Laboratory has developed a coat which consists of zinc borate and chrome green ground in linseed oil. This paint after three years of exposure to the weather has retained its fire resisting properties.

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A Costly Experiment

JUST as we go to press, the news comes over the seas of the terrible loss of life caused by the collapse and subsequent explosion of the new giant airship ZR-2. She carried to their death no less than forty-four men, among them some who had won distinction in the field of air conquest. It is not clear at this date just who was killed and who was saved, but the number seems to be established without much doubt.

The airship was the largest that has so far been built, and her dimensions far exceeded those of the R-34, which was hailed as a wonder. She was designed to have a carrying capacity of forty-four passengers and two tons of freight, carrying enough fuel to make a high speed non-stop flight of 48 hours. Her total lifting capacity was 83 tons, and she was designed primarily as a fighting machine. She had been in the air a considerable time when the accident happened, and had reached her destination, but owing to a mist that was encountered, the commander decided to remain out till daylight, and accordingly shaped his course back till they were again over the city of Hull where the accident happened. There seems but little doubt that the cause of the failure was the breaking of some vital parts of the ship's framework, due to stresses thrown on it which had been impossible to foresee when the calculations were made. There must necessarily be, in the design of such a structure a number of indeterminate stresses, which are allowed for by making the factor of safety large enough, or supposedly large enough, to provide the necessary resistance for any stress that may be encountered. In this case something occurred that stressed a member or members beyond the point of resistance and the fatality ensued. It is to be earnestly hoped that enough of the wreck may be saved to afford an indication of what happened, so that future designers, with the weak spot made known to them, may build a structure in which all the stresses are known and amply provided for.

The sympathy of the whole world will go out to the men who died and their surviving relatives, and their names will survive as pioneers who perished for the advancement of the race.

Signs Of A Revival

THE news from the various freight markets of the world show that there is at last some signs of that revival in the shipping trade, that has been earnestly looked for. This follows the resumption of work by the coal miners in Great Britain, and the progress of the price of this fundamental necessity to industry to more reasonable levels. Shipowners are once more enabled to send their vessels on long voyages in ballast, to bring return cargoes home, without the whole revenue of the voyage being eaten up in fuel costs. However, the price of coal has not yet reached the level where it can be exported to any great extent, and the fact that European countries have on hand large stocks of American coal that were shipped during the strike also militates against export of British coal for the time being. This will adjust itself in time, and there is little fear of American competition in this trade once conditions are normal. Another faint hope arises, in contemplating the appalling condition of Russia, that the powers there will be at last convinced that their effort towards a Communistic state has proved abortive, and that agriculture and industry may once more be resumed in that tortured land.

On the whole, the situation looks somewhat better than it did six months ago, from the shipowner's view point, even with the competition of various state owned lines to complicate the situation. The British-owned ships are largely of a more convenient size and generally more efficient than those of her chief rival, and will have no difficulty in holding their own in any sort of an open market.

The U. S. Shipping Board

AN American contemporary has come out with a bold plan for straightening out the tangle into which the U. S. Shipping Board fleet has got itself. This is a simple, but withal heroic remedy. The idea is to sell the ships if possible, and if not, sink them. This is perhaps not so wild a suggestion as it would appear at first sight. The fleet as it stands today is costing the U. S. taxpayer millions of dollars annually, for which there is not the slightest prospect of any return. The appointment of three practical shipping men as vice-presidents in charge of actual operation is a good move, but good as these men may be they cannot perform miracles. The whole of the wooden tonnage represents a hopeless loss, as these ships are utterly impossible from any commercial standpoint. From the value of the steel fleets, millions have been or are about to be written off, which will enable them to be offered at a lower price but there are many of them which are unsuitable in size and design for world trade. Owing to the penalty of high wages and high operating costs those that can be kept running are so kept at a loss in every voyage, while from the standpoint of efficiency in operation they are notoriously lacking. The real reason behind the refusal of the Egyptian cotton exporters to charter American ships at a lower figure than they could get British ships at, was due to this inefficiency.

The contemporary in question gives some appaling figures as to the cost of the fleet. The wooden ships are costing $135,000 per month to keep in idleness, while the recent losses of the whole fleet are put by President Lasker of the Board at $300,000,000 per annum, and to keep the Board alive till the end of the year will need a sum of $125,000,000. The losses according to the board's books in operating the fleet amount to $10,000,000 monthly, while repairs consume the neat little sum of $2,000,000 per month.

On the face of these figures the suggestion that the ships be sunk if no other way presents itself of getting rid of them is on the whole not a bad one, and from the point of view of private shipping interests, an excellent one. We are afraid that the suggestion carries little prospect of fruition. The U. S. taxpayer is not yet fully alive to the cost of his bid for sea supremacy.

News of the Shipping World

SOME interesting details are to hand connected with the salvaging of the tanker "Impeco" from the Blonde Rock, at the mouth of the Bay of Fundy. She is the first vessel of the many that have gone on that rock to ever come off it, and great credit is due to the salvers, the Maritime Wrecking and Salvage Co of Halifax. The vessel which was pierced in every compartment, was in such a position that it was impossible for the salavge steamer to get alongside of her, and this increased the difficulties of salvage. The method employed was that of pumping the water out by means of compressed air, or rather forcing the water out. The salvage crew went aboard the wreck by means of small boats, and laid a six inch pipe fore and after, with branches to all compartments, This work was hardly accomplished, when a gale of wind sprang up, and washed all the piping away, and the work had to be done all over again. After getting the pipe laid, a six inch hose was floated from the salving steamer to the wreck, the salvage steamer being moored by heavy ground gear and lines to the wreck. Pumping was started and the wreck moved, but owing to the wind and tide the salvage vessel could not hold her position, and work had to be stopped. The next day pumping was resumed, and after a couple of hours the vessel f oated and was towed off. The start was then made for Clarke Harbor, the nearest point, and during the run there another danger was encountered. A large quantity of oil had been forced out of the "Impoco" and this floating on the water, was set fire to by a fisherman carelessly throwing a match into it. He luckily escaped with nothing more than a bad fright and a scorched boat, but owing to the "Impoco" leaving a wake of oil astern of her, the fire rapidly started to overtake her and the salvaging fleet. In order to make a break in the continuity of the oil, the air compressors were stopped for a while, and the fire then burnt itself out. On arrival at Clarks Harbour the wreck was beached while further repairs were carried out, after which she was taken to Halifax for permanent repairs. The whole job was a particularly risky one, and the salvers worked under very arduous conditions.

THE steamer "Western Front" which was recently burnt in the English Channel, figured in a rather exciting rescue but a short time before she was burnt. While on a voyage from New York to Algiers with coal, she sighted a dismasted schooner, the "Silver Queen". The latter vessel was bound from Labrador to Malaga with a cargo of cod fish. As the steamer approached the schooner the latter's crew put off in their boat, and it was then discovered that the schooner was on fire. The captain stated that as his cargo was rotten, and the vessel leaking badly, he had fired her so that she would not remain afloat a danger to navigation. The captain of the "Western Front" called for volunteers from his crew, and when they were obtained put them aboard the schooner where they divided forces some pumping the vessel out while others subdued the fire. The "Western Front" then took her in tow and proceeded to Lisbon. The Admiralty judge, before whom the case for salvage was brought, awarded the steamer $4000 salvage.

THE new United States Shipping Board has entered into its thankless task of trying to clean up the awful mess which it has inherited, and seems to be going about it in a sensible way. One of their first acts was to wipe off a good round sum from the valuation of the fleet, which will give it a chance to operate on a more reasonable capitalisation. It has also appointed three vice-presidents, each of whom is a practical shipping man, something of which the board has long stood in need. The gentlemen in question are Mr. William J. Love, Mr. A.J. Frey and Mr. J.B. Smull. The first was up till the time of his appointment the assistant American manager for Messrs Furness Withy & Co. and has had a long experience in actual ship operation. Mr. A.J. Frey is also a practical shipping man, and was identified with the Pacific Mail, and later the Los Angeles Steam Navigation Co. The last member, Mr. J.B. Smull, who has had a long experience as a shipbroker, was vice-president and manager of Messrs J.H. Winchester & Co when he was appointed to the board.

AN ENQUIRY into a rather unusual case of scuttling a ship has just come to an end in the Glasgow court. The case is that of the steamer "Spathari", which was on a voyage from Rotterdam to a Greek port. When about 5 miles off the Portuguese coast, and eighteen miles south of Burling Island, the vessel was abandoned, but did not sink for hours afterwards. The captain was a veteran of 67 years of age, who had been through very trying experiences during the war, having been torpedoed three times, and was evidently not fit for any position of responsibility at sea. The fact that the vessel was going to be sunk seems to have been well known to most of those on board before the event happened, and every preparation was made to abandon the ship. The instigator and perpetrator of the scuttling was the chief engineer, who has since been arrested on a charge of scuttling the vessel. The remarkable part of the occurrence is that so far no motive has been unearthed, as there has been absolutely no evidence to show that the owner was concerned in the act in any way. The vessel and cargo were amply insured, but the court of enquiry expressly stated that there was no proof of conduct involving blame on either the owner or the registered manager. It will be interesting to see what new facts come out when the chief engineer is put upon his trial. He may uncover some information when he is placed in a position involving the risk of a long term of imprisonment.

THE Canadian Government Merchant Marine has sustained a double loss this month in the breaking up of the "Canadian Exporter" and the sinking of the "Canadian Recruit". There is some probability that the latter may be salvaged, but owing to the nature of the bottom where she is lying this is not by any means certain. The "Canadian Recruit" has had an unfortunate career, her troubles starting with her first voyage, when she was caught in the ice at the mouth of the Gulf of St. Lawrence, and drifted ashore, sustaining very serious damage. The Canadian people will have a good opportunity of realising that shipowning is not an unmixed blessing as time goes on.

THE strike of ships joiners which has been in effect now about eight months, in all the old country yards, is still continuing. There have been conferences, but the men have presented such an unyielding attitude that nothing has come of them. One of the results of this strike has been the loss of millions of pounds worth of work to all the other trades connected with shipbuilding, as ship after ship has been sent to the Continent for repair, owing to the impossibility of getting the work done in English yards. It appears now as if the "Mauretania" will have to be sent abroad for the very large repairs necessary after the recent fire. This job will be very largely woodworking, and the joiners must feel very sore at seeing that piece of work lost to themselves. The unreasonable feature of the thing is this, and it sheds a good deal of light on the attitude of trade unionists towards their fellows. While the striking joiners can obtain employment in the building trade which is experiencing a boom just now, their actions prevent the engineers, boiler makers, tinsmiths etc from getting work, and keeps thousands of them walking the streets, while the money goes into the pockets of the greatest rivals of Great Britain. The shipbuilding firms came to an agreement with the Executive Council of the joiners' society three months ago, but the local district delegates of the society refused to abide by the agreement made by their Executive. Under such conditions it is little wonder that trade is being lost, some of which may never come back.

THE recent unpleasantness over the transportation of Egyptian cotton to the U.K. and U.S. seems to be in a fair way to a settlement, the negotiations being now carried on by the U.S. Shipping Board representative in London, having been taken out of the hands of the Alexandria representative. The trouble arose over the fact that the exporters of cotton accepted a tender put in by British shipowners, which was higher than that of the U.S. shipping board. The Shipping Board retaliated by putting in a still lower tender, but the exporters still gave the preference to British ships. The Shipping Board representative at Alexandria then threatened to invoke the Jones Act, and to adopt all kinds of discriminative methods against British ships, but wiser counsels prevailed. The real reason that Egyptian exporters prefer to pay a higher rate to British shipowners is because they are sure of their cotton arriving at destination in good condition and the British ships can offer better facilities and service. The U.S. Shipping Board has evidently not yet achieved that mastery of the seas that they fondly hoped for in the early days of the renaissance of the U.S. Merchant Marine.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

THE NEW DIAMOND VALV-IN-HEAD SOOT BLOWER

AN ENTIRELY new principle has been introduced in soot blower design. The valve, controlling the individual unit, has been incorporated as an integral part of the head.

Let us for a moment briefly review recent developments in this important branch of power plant practice. The past few years have witnessed on the part of engineers everywhere, a marked growth in appreciation of the importance of rapid, thorough, mechanical removal of soot from the heating surfaces of steam generators. Coal and labor have constantly advanced in price. At the same time there have been unprecedented demands upon the boiler capacity of practically every boiler plant. The situation has called for systematic study of every factor affecting combustion. This analysis has proved the mechanical soot blower to be one of the best paying investments in the boiler room.

A large measure of the success of the mechanical soot blower has been due to the constant improvement in design and construction. Among the improvements of the past few years are the following:

1 The introduction of calorized metal for the protection of the blower elements from oxidation at high temperatures.

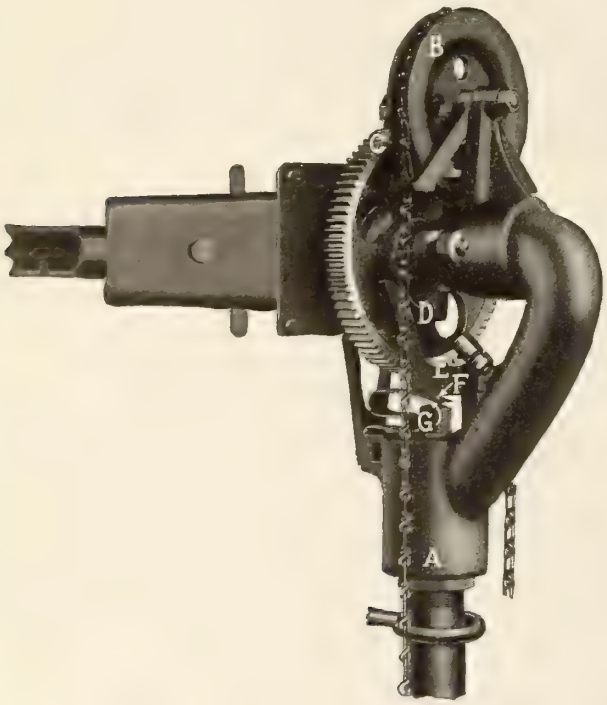
2 The adoption of nozzles of a Venturi section to secure the highest possible velocity of the steam jets.

3 The development of special processes for welding these nozzles in place.

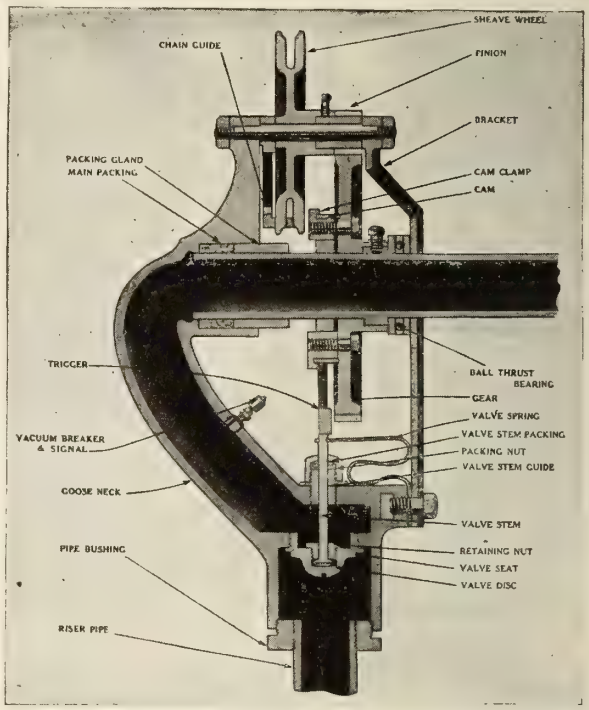
4 The designing of steel bearing to support the blower elements.

5 The introduction of the vertical header system of piping.

The successes heretofore registered have proved a spur to further efforts. Hence, we have the new Valv-in-head soot blower, manufactured by the Diamond Power Specialty Company, of Detroit, Mich.



General view of the apparatus.



Sectional View of the blower.

Head Constructed On New Principle

The Valv-In-Head soot blower is provided with a special Monel valve of the poppet type, placed at the base of the gooseneck. This valve takes the place of the globe valve which has always heretofore been installed (at a distance of two to fifteen feet or more from the head) in the riser pipe leading from the main header.

The special valve just referred to is located at the point marked "A" in the illustration, Figure 1.

The unit is operated in the following manner: The main control and drain valves which are the only independent valves on the soot blower line, having first been opened, and all piping drained and heated, dry steam fills the line to the entrance of the individual valve at the base of the gooseneck "A". The sheave wheel "B" is then revolved by pulling the chain. This turns a small steel cut pinion gear (not visible in the illustration). The small pinion engages the large gear "C" which is fixedly mounted on the blower element. As the gear is revolved, it operates a cam "D" which causes the lever "E" to press down the steam stem "F", causing the valve to open at a predetermined point in the revolution. After the gear has been further rotated, the cam "D" releases the lever "E", allowing the steam pressure to close the valve at a second predetermined point in the revolution. As steam leaves the line, the spring "G" holds the valve closed.

Construction of Valve

The valve is made with the Monel metal disc and seat. Both the steam and

its retaining nut are made of nickel steel. In order to secure extra hardness, which insures durability, the end of the stem is heat treated. A special feature is the provision of a guide on the seat, which permits leaving the stem loose in the disc so that the valve will always seat properly. The entire construction is such that the troubles common to globe valves, such as "wire-drawing," leakage, etc., are almost entirely eliminated. Disc and seat are readily accessible so that they may be removed easily for regrinding or renewal, should occasion ever require

As the tendency towards high pressure and superheat is very marked in modern power plant design, the Company manufactures a special body Valv-in-Head soot blower for such boilers as require this type of equipment.

Cam and Lever Construction

The movement of the cam is positive, assuring complete automatic opening of the valve at each operation. The cam and the clamps which hold it in place are made of steel. The length and relative position of the cam is individually determined for each unit at the time of the installation.

The valve lever, which is also made of steel, is designed with a ratio of two to one, and as the reduction of the gears is ten to one, the opening of the valve is as readily accomplished as is a lever with a power arm of one hundred inches and a resistance arm of five inches was used. The spring is made of chrome vanadium. As the spring is away from heat, it always keeps its tension.

Vacuum Breaker and Signal

A very unique idea has been successfully worked out in the Valv-in-Head blower. Each head is provided with a vacuum breaker for the purpose of preventing the suction of furnace gasses into the blower element during the periods when steam is off the unit. In the present head this vacuum breaker has been designed in the form of a small brass whistle.

During the time the soot blower is in operation, the whistle sounds, furnishing both an audible and a visible signal, so that there is no opportunity for the operator to leave steam on the unit for a moment during which he is not revolving the blower, without the fact becoming readily apparent to any one in the vicinity.

Chain Guides

An important feature of the Valv-in-Head blower is the provision of guides to prevent the chain from slipping off the sheave wheel. It is not always convenient for the operator to stand directly under the unit, and the use of the chain guides enables him to operate the blower from any convenient point, without facing the possibility of having to hunt up a ladder in order to replace the chain on the sheave. The chain guides, in common with many other parts of the head, are made of steel.

A very marked step forward has been taken in the design of the Valv-In-Head soot blower, through the provision of a ball bearing to relieve the friction caused by the thrust of the unit, due to steam. As will be seen from the cross section of the head, this ball thrust bearing is located directly back of the steel wall bracket which supports the blower element. Its presence relieves friction so completely that the Valv-in-Head unit turns as readily when the steam is on as when off.

Floating Features Of The Valv-In-Head

The necessity for some means of eliminating the binding of soot blower units resulting from movement of the boiler tubes under the forces of expansion and contraction, is now generally recognized. An important development in connection with the Valv-In-Head soot blower is the wall-box, with floating mechanism, which provides a means of taking care of any shifting of position of the blower element without causing dislocation of the wall-box, cracking of brick work, or expansion strains on soot blower head and brackets.

Elimination of Condensate.

One of the most important results of the use of the Valv-In-Head blower is the practical elimination of the possibility of water entering the portion of the soot blower inside the boiler. With the independent valve type of soot blower, the valve is located anywhere from 2 to 15 feet or more from the head. This means that condensation will inevitably take place when the valve is admitted to the cold line. The water thus formed is driven through the soot blower head and into the blower element.

In addition to the condensate thus formed in the line a more serious possibility is that a small leak in the valve will cause water to form in the pipe before the valve is opened. When this occurs, a solid column of water may be built up in the riser pipes and carried over the boiler when the valve is opened.

The presence of this condensate in the hot blower element is apt to cause warping and its discharge on the boiler tubes may cause the soot to pack, forming a gummy mixture hard to remove.

With the Valv-In-Head system, any condensate in the main supply line is discharged through the drain pipes before blowing begins. There is, therefore, no water below the valve which can be carried into the blower head, and the radiation area in the head itself is so small as to be negligible. Hence we have practically complete elimination of condensate from the blower element.

VICTOR DAMPER REGULATOR

The accompanying illustrations show the damper regulator manufactured by the Atlas Manufacturing Co., New Jersey, U.S.A. and known as the Victor Damper Regulator No. 3.

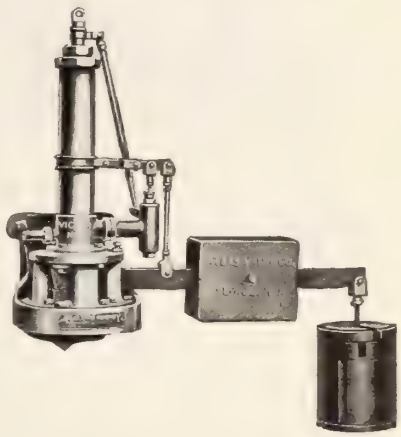
Installation

The regulator is furnished mounted on a cast iron bracket, which should be bolted to the wall adjacent to the boiler. The control piston should be connected to the damper with chain over pulleys, so that the damper is held wide open when the piston is down. The damper should then be counterbalanced so that it will close on an upward movement of the piston.

The water supply should be taken from the cold water line and connected to connection A (shown in illustration).

The steam pressure connection should be taken from the gauge line or boiler header and connected to the diaphragm at B (shown in illustration).

The discharge connection should be run from connection C on the pilot valve (shown in illustration) and run to any



convenient drain or to the ash pit.

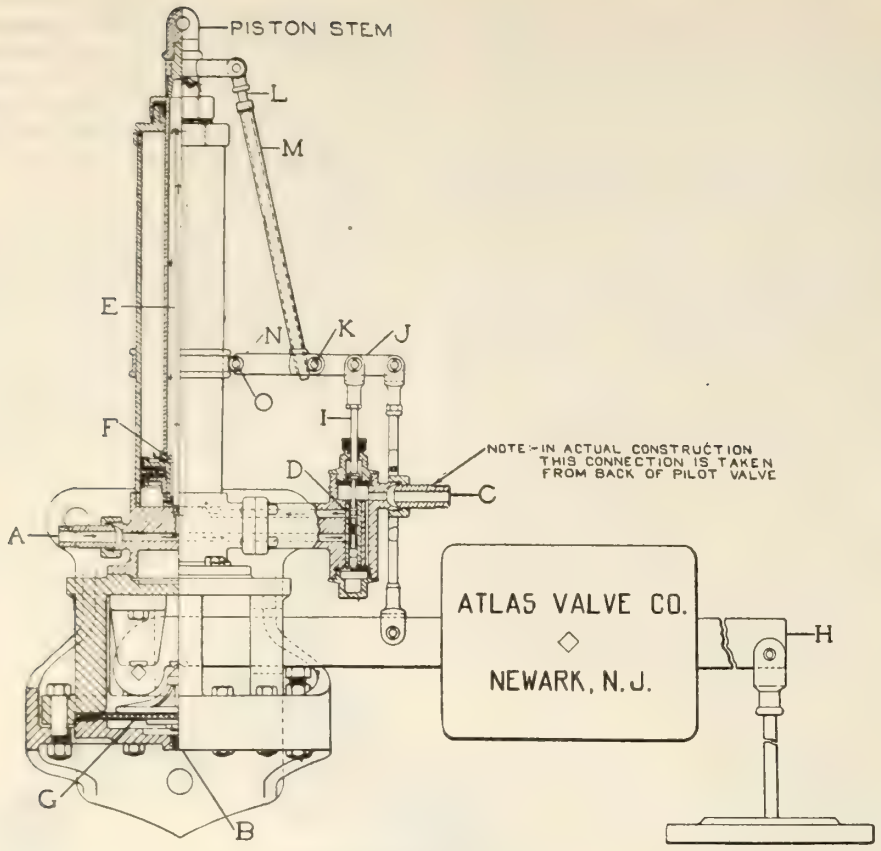
By referring to the cut it will be noted that the direction of the water current is indicated by the arrows. The water pressure enters the regulator through the inlet A, passing to the pilot valve, then to the bottom of the control cylinder through port D. It also passes to the control cylinder on top of the piston through pipe E into the hollow piston stem and into the control cylinder through holes F.

The pilot valve stem I is of spool form with the upper head passing over port D. when above the port permits the water to pass into the bottom of the cylinder, and when below the port permits the water to escape from the bottom of the cylinder into outlet C.

By referring to the cut it will be noted that the area of the top of the piston is reduced by an amount equal to the cross-sectional area of the piston stem, whereas the area of the bottom of the piston is larger. We therefore have two opposing forces pushing against opposite sides of the piston, the constant pressure acting against the lesser area on top of the piston tending to force it down and the variable pressure from the pilot valve tending to push it up. Therefore when pressure is admitted to escape from the bottom of the cylinder the constant pressure forces it down.

Explanation of the Compensating Attachment

When the steam pressure under diaphragm G, is sufficient to raise lever H, the pilot valve stem I, is pulled up by lever J, swinging on axis K, this per-



Sectional View of Regulator

VICTOR DAMPER REGULATOR

(Continued from page 34)

mits the water to pass into the bottom of the control cylinder and force the piston up.

As the piston moves up rod L is pulled upward in sleeve M, which is rigidly attached to lever N, swinging on axis O. As the point where rod L is attached to the piston stem travels in a straight line, the angle at which sleeve M stands is lengthened and to meet this longer angle sleeve M must swing outward, which depresses axis K on the end of lever N. This pushes pilot valve stem I down so that the upper head of the stem covers port D, and shuts off the water supply to the bottom of the control cylinder which checks the upward travel of the piston.

When the steam pressure falls, lever H lowers and pulls pilot valve stem I down, so that its upper head is below port D. This permits the water in the bottom of the control cylinder to escape into outlet C, which allows the constant pressure on top of the piston to force the piston down.

As the piston moves down rod L, sliding into sleeve M, shortens the angle at which sleeve M stands and to meet this shortened angle, sleeve M must swing inward, which raises axis K, and pulls pilot valve stem I up so that the upper head of the stem covers port D, and shuts off the water discharge from the bottom of the cylinder, which checks the downward travel of the piston.

The importance of the compensating attachment cannot be overestimated as it acts as an intermediary medium to counteract the movement transmitted to the pilot valve by the steam pressure under the diaphragm, which balances the position of the damper on intermediate pressure changes, and permits the damper to be fully opened or closed only on extreme boiler pressure variations.

NEED OF INSPECTION

The Editor, Power House:

Enclosed is a clipping from a local paper and it shows the need of some one to inspect such boilers and report to those higher up. I would suggest that if it could be done one man should be appointed in each county to inspect such boilers as these, the inspection fee to be paid by the owner. It might help to improve the care given by those in charge.—N.E.A.

"The corporation's road roller has been inactive for the past day or two on Thames street north. A crack in the boiler is held responsible, and in turn, carelessness is held responsible for the crack. A boiler expert from Woodstock was working on the machine yesterday, and stated positively that nothing but carelessness could be held responsible. He had to chisel through the thickest boiler plate he has encountered in a lifetime of boiler work in an effort to remove the cracked portion. Within he found the scale and sediment of a long term of carelessness. "This sediment should be cleaned out every two weeks" said he. "In this boiler there was a great thickness of scale. The water could not get to the plate, with the result that it soon burned and cracked. Every boiler should be washed out at least every two weeks. That prevents the accumulation which means boiler ruin. This boiler had the best material in it I have ever worked with, and with any kind of care, would have lasted a lifetime."

One of the workmen present stated that the idea had been advanced that the roller is used only about two weeks in every year, and there had not been the proper precautions taken on that account.

"It makes no difference how long it is used in a season. It should be washed out every two weeks while in use. It should then get another cleaning out when put away for the year. Unless this is done, it cannot be expected to be in good shape when taken out the following spring."

A large patch has to be attached to the outer surface of the boiler, and it was expected that this would have been completed by Thursday evening. The expert was asked what it would cost to put the boiler in good shape, flues, boiler and all.

"I would say roughly that it would cost over a thousand dollars" said he. "Of course I have not gone into the matter, but I would say that with a fair degree of certainty. That is the price of carelessness. This is an excellent boiler and would have lasted indefinitely had it been given proper attention. There are too many bosses in council jobs, and too many having the care of the roller in their hands. There should be some one who would see that a corporation machinery of this kind was given the attention it should have, and there would be money saved for the corporation."

The above is an example of the need of inspection of all boilers, whether large or small. This is a case evidently where every one's job is no one's job. It would be interesting to know how many cases like this occur in a year.

We had occasion to inspect several boilers of this type some years ago in an Ontario brickyard, and the internal condition of these boilers was little short of disgraceful. The owner was profoundly surprised when we mentioned the necessity of cleaning them and said they had never been cleaned during his ownership, which extended over several years. He had recently had them insured, hence the inspection.

The Armstrong Cork Company, of Pittsburgh, Pa., have issued a small folder entiled "Four Reasons" which describes the use of the Nonpareil High Pressure Blocks and Cement manufactured by the company. These are designed for insulation of all high temperature equipment.

Mr. H. T. Day, of Mirlees, Bickerton & Day, Ltd., who are the manufacturers of Mirlees Diesel Oil Engines, is at present in Canada on an extended tour. The firm Mr. Day represents have a large number of engines installed in various parts of Canada, and Mr. Day purposes visiting each installation during his trip.

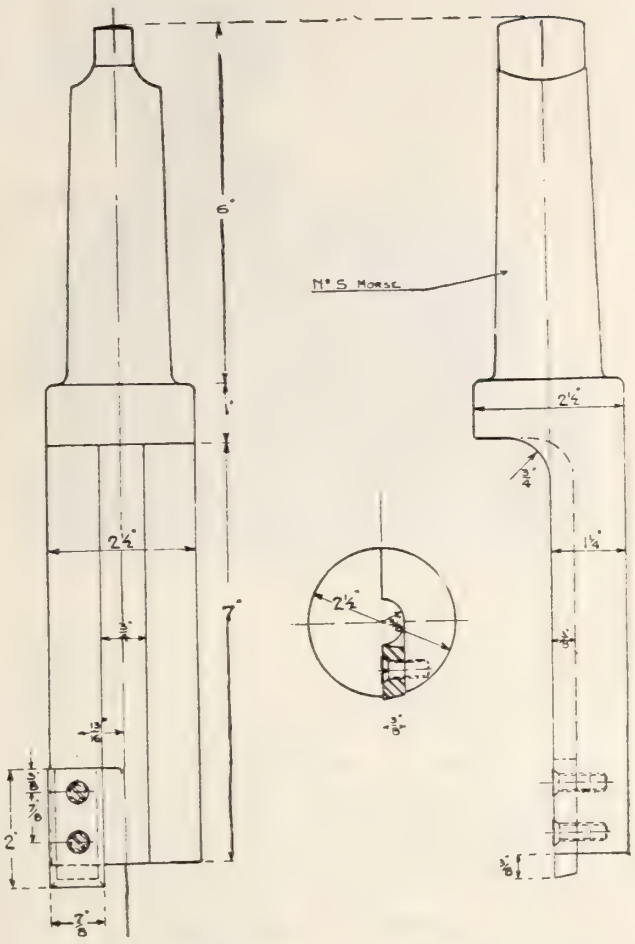
What Is a Drilling Job?

THE DRILLING machine has remained a surprisingly simple tool when compared with some other machines, according to R. S. Mallison, and yet, as he says, its range and capabilities are almost unlimited. Speaking on the subject of "What is a Drilling Job" he states in British Machine Tool Engineering, that amongst many unusual operations he has seen executed on the radial drill, the ones shown in the present article are particularly worthy of mention. He states that in the one case the work was mounted in a special jig or bridge, in the top of which was a pilot hole with a standard thread. When drilling and opening out the hole by bar and cutter, a bush was screwed into the pilot hole, being taken out for threading operations.

A bar with a master thread was used, fitted with a single cutter, the threaded portion of the bar engaging with the pilot hole threads just before the cutter enters the work. When the spindle is started the tool, of course, automatically feeds down to cut the corresponding thread in the work. I saw a 5 in. diameter hole bored and threaded by this method, with accuracy and in about one third the time occupied for the same operations on a lathe.

On the other occasion the setting lugs of aluminum gear cases for motor waggons were being sawn off. A horizontal circular saw was fastened to a morse taper shank, which latter was cottered into the drill spindle. The spindle was then adjusted to the correct height, the friction applied to hold it from slipping, and the lugs sawn off by moving the radial arm. This method gives quite good results besides eliminating the necessity for moving to another machine.

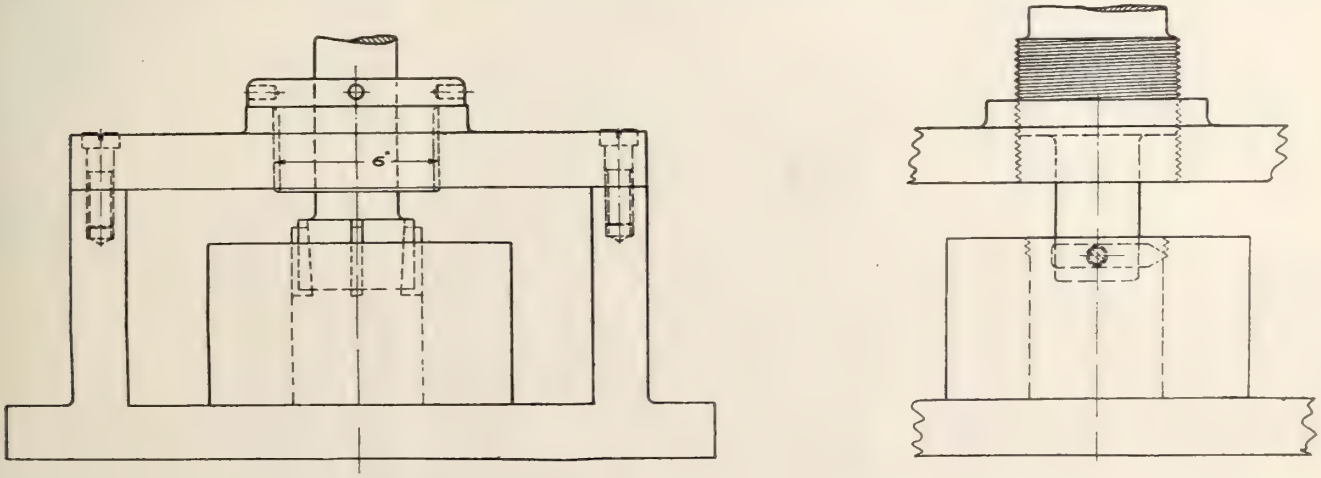
Particularly interesting is the machining of connecting rods in locomotive shops. A special tool usually known as a "D" cutter is employed to cut out of the solid, a lubricating well about 2½ in. diameter, leaving a solid piece of metal in the center. The latter is then drilled for the syphon, and the outer face of the well is threaded for the purpose of screwing in a cap. All these operations are executed on the one drilling machine.



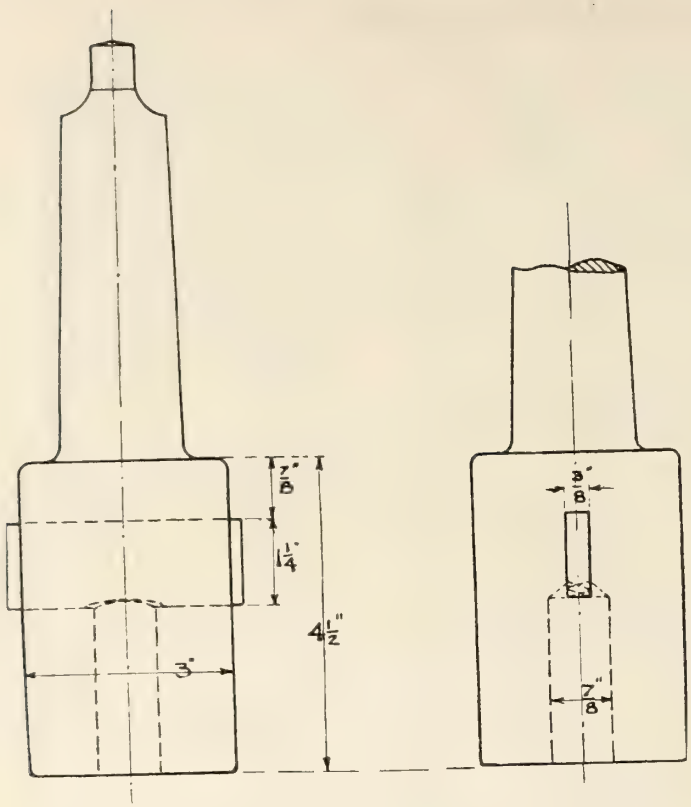
What is known as a "D" cutter.

By the use of a simple form of tie-rod the heavier radial drilling machines can be immediately converted into a rigid form of vertical boring machines. Cylinder boring is executed to advantage by this method, various forms of cutters being employed. Large holes are bored in steel and wrought iron jobs which could not be accommodated on horizontal borers without some difficulty, and, in many instances, with an appreciable saving both in setting up and machining times.

On one occasion the writer saw a box body vertical drill with a compound work table, on which was fastened a universal chuck, used to distinct advantage for boring blanks and flanges. The users were enthusiastic about the job, for it was saving both power and time on an expensive turret lathe. Trepanning is another operation usually assigned to the radial drill. A pilot hole



Showing the jig used for drilling, opening out and threading.



Showing the tool used for ending studs.

is first drilled in the center of the job, which acts as a steady hole for the trepanning tool. This latter has two adjustable cutters, carried in a horizontal slide, which are set to the diameter of the hole required. By this method it is possible to cut out a hole up to twenty inches diameter in cast iron on the heavier radials. On one particular occasion the writer noticed trepanning operations being executed on crank webs without the use of a pilot hole, a specially strong tool being employed. The finished hole was 14 in. diameter, and the metal removed was then machined for another job. This procedure must have resulted in a fairly considerable saving each year.

The improved powerful friction on Asquith radials, for instance, makes them suitable for milling and keyseating to a surprising degree. The spindle is securely held by this friction arrangement, thus preventing it from slipping. The milling cutter is horizontal, of course, and the traverse is obtained by the movement of the saddle along the arm. The use of tie-rods gives rigidity for this work. The vertical drilling machine with its compound work table has even greater advantages than the radial for these operations, as the work can be accurately adjusted both longitudinally and transversely. In one particular instance, to my knowledge, an Asquith box body machine is used practically as much for milling and keyseating as for the ordinary run of drilling jobs.

THE CLYDE'S LARGEST DREDGER

The largest dredger ever built on the Clyde was launched recently. It has a hopper capacity of 80,000 cubic feet and carries a suction pipe by which dredging can be done to a depth of 45 feet. Special arrangements have been made to enable dredging to be continued when the vessel is going either ahead or astern. This dredger is designed for dealing with light sand at the mouth of an Indian river, and an ingenious device has been fitted to trap this light sand so that none of it is wasted in the overflow. Everything in the hull and equipment is A. 1. at Lloyds. A complete system of electric lighting, including one searchlight, has been installed. The pumps are driven by a special set of triple expansion engines and are capable of raising and discharging about 5,000 tons of sand and silt per hour.

KILLING ATMOSPHERICS

One of the most troublesome difficulties in wireless telegraphy is the interference caused by what are known as "atmospherics." The receiving instruments are affected by electric waves which arise no one quite knows how. They are worse during the day than at night and also during certain weather conditions. For many years a British company has been striving to overcome this difficulty and it has at last been rewarded by the discovery and perfection of a device by which the effect of "atmospherics" can be quite eliminated. What this means in practice is that existing wireless stations can carry far more messages than they have yet been able to do. Every now and again the use of automatic signalling at high speed had to be given up and oral reception employed, owing to the way in which the atmospherics played havoc with the machine records of the signals. A skilful operator could disentangle the human signals from nature's freaks, but the speed at which an operator can receive is limited. It is not too much to say that this British invention will multiply the efficiency of wireless telegraphy ten-fold.

THE SMALLEST PUMP IN THE WORLD

What is the smallest pump in the world? This is a difficult question to answer, but it would be equally difficult to light upon any pump at once smaller and simpler than that recently devised by a British Engineer. It consists of a piece of rubber tubing bent into a hoop, with a wooden frame outside the loop and a circular cam inside. By placing the cam out of centre and revolving it the rubber tube is squeezed in a rotary direction, giving a kind of "milking" action which will force liquid through it. One end of the tube then becomes the suction pipe and the other the delivery pipe of a very neat and efficient form of pump. The inventor after having made a pump out of a serviette ring and piece of rubber tubing, has take out a patent for a regular engineering mechanism on the same principle. He proposes to use a flexible rubber or leather band suitably watersealed on its width, in place of the tubing, and cast iron or gun metal casing with suction and delivery branches. This type of pump, it should be noted, has no valve and will therefore be suited for use in cases where pump valves are apt to give trouble.

Seattle.—The steamship "Friesland," a former German vessel, recently left this port with the largest cargo of wheat ever shipped through the Panama Canal. The "Friesland" is now owned by the British Ship Controller and is bound for Avonmouth, Bristol Channel. The cargo consisted of 504,597 bushels of wheat, and it is said to be not only the largest cargo of wheat to be shipped through the Canal, but the largest ever put aboard a single vessel on the Pacific Coast.

Quebec.—The "Canadian Recruit" was sunk in the Traverse about 45 miles below Quebec, after being in collision with the collier "Maskinonge", of the Dominion Coal Company's service. The "Canadian Recruit" is one of the C.G. M.M. steamers, and it will be remembered that she had a bad time on her first voyage, being caught in the ice in the Gulf, and badly damaged. An attempt was made to beach the "Canadian Recruit" after the collision, and this it is believed was partially successful.

ENGINE GENERATORS

THERE has been placed upon the market, a Westinghouse-Sturtevant Marine lighting set which is especially adapted for lighting and power on shipboard. These outfits have absolute light weight, compactness and economy of operation. Both the engine and generator making up these sets embody the results of considerable engineering and manufacturing experience. Perfect automatic lubrication, elimination of vibration, low piston speed, sparkless commutation, and excellent voltage regulation are features of the design.

The frame is made oil and dust proof and provided with large openings having cast iron covers in such a position as to give access to all parts subject to wear. In the top of the frame is cast an oil reservoir for the lubricating system.

An ample distance piece separates the cylinder and frame in which are enclosed a watershed partition and stuffing box, together with the piston rod stuffing box. The watershed partition prevents the water from the cylinder leaking into the frame and the oil in the frame from being carried into the cylinder.

The cylinder is of close grained iron, cast in one piece with the valve chest. Both are thoroughly insulated with non-heat conducting material, and covered with a lagging of planished steel. The cylinder is equipped with relief valves of large diameter, which may be adjusted to open at any desired pressure. These guard against damage to water coming over with the steam.

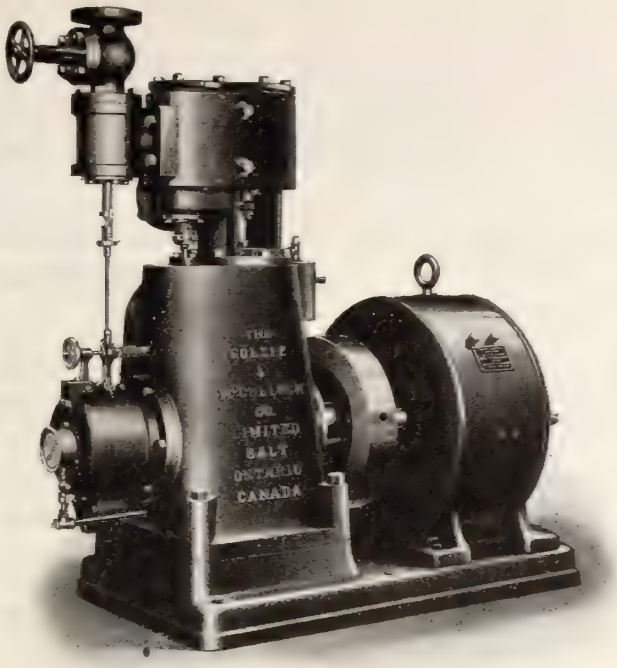
The valve is of the piston type and operates in a renewable bushing, which forms the valve ports. The valve is connected by means of the valve stem, slide eccentric rod and eccentric strap to the eccentric attached directly to the governor. All pins and rods are of open hearth steel and the bearing pins are hardened and ground.

The engine is equipped with an inertia governor of the well known Rites type. This governor is placed in a heavy fly wheel and is capable of very close regulation keeping the variation between no load and full load as low as one and one half per cent.

The piston is of cast iron, cored for lightness and fitted with cast iron snap packing rings, turned to perfect contact. It is pressed to a taper fit on the piston rod, and is further secured by a nut pinned to the rod. Both the connecting rod and the piston rod are of open hearth forged steel, each in a single forging. The crank pin end of the connecting rod is provided with malleable iron, marine type boxes, and the crosshead end is fitted with brass boxes of the same design.

The crankshaft is of open hearth steel made in a single forging, machined all over and carefully fitted with balancing counter weights secured to the webs, the crank pin being hardened and accurately ground to size.

The lubricating system is automatic, continuous and self-contained, requiring no independent tank or reservoir. In engines having gravity type lubrication, the oil is pumped from the reservoir in the base by a chain driven rotary pump which is entirely submerged in the oil, to the upper reservoir cast in the top of the frame. From here it flows by gravity through brass pipes to the various bearing surfaces requiring oil, then back to the reservoir in the base where it is strained and pumped again. Where a forced feed system of lubrication is furnished, the submerged pump forces the oil under pressure through brass pipes direct to all parts requiring lubrication. The oil then drains back to the base, where it is strained and again forced through the system. An oil well level gauge is supplied, attached to the outside of the base.



With every engine there is regularly furnished: An automatic hydrostatic type lubricator, a set of wrenches, and anchor bolts with plates when required.

The Westinghouse "SK" generator is especially constructed to meet the requirements of marine service. The frame is forged from open hearth steel, eliminating the possibility of blowholes as in cast material and resulting in a light compact but strong construction.

The bearing on the generator is a solid steel shell, babbitt lined and so constructed that no leakage of oil will occur with listing of the ship.

The armature coils are so constructed that no cross overs on edge occur, thus eliminating a prominent cause of armature insulation breakdown. Both armature and field windings are impregnated with a special compound for resisiting the moisture and salt atmosphere found in marine service.

One of the fundamental ideas of the design is the open, well ventilated construction. The air can circulate freely through the generator, coming in thorough contact with all internal parts and thus eliminating the possibility of internal hot spots which in time could not fail to have a damaging effect on the insulation.

Sparkless commutation results from the application of commutating poles and consequently the wear of commutator and brushes is reduced to a minimum. This is especially so since the speed of these sets is relatively low. The brush position is fixed before the set leaves the factory and never requires any adjustment.

Non-corrosive material is used for brush holders and all parts which might be effected by moisture.

SIZE OF CRANKSHAFT

Question: What should be the size of crankshaft for a steamer, with cylinders 12x24x18 inches, stroke revolutions 175 per min. cranks at 90 degrees.

Answer: The Board of Trade rule for crankshafts of compound engines is as follows—

$$S = \sqrt[3]{\left(\frac{C \times P \times D^2}{f\,[2+(D^2 \div d^2)]}\right)}$$

Where S = Dia. of shaft.
d^2 = Dia. of H.P. cylinder squared.
D^2 = Dia. of L.P. cylinder squared.
P = Absolute pressure per sq. in.
C = Length of cranks in inches.
f = Constant. (For cranks at 90° f=1047).

Substituting figures, we get

$$S = \sqrt[3]{\frac{9 \times 190 \times 24 \times 24}{1047[2+)24 \times 24 \div 12 \times 12)]}}$$

which gives 9.77, say 9¾ inches.

Port Huron.—The Chamber of Commerce of this city is considering calling a meeting of Chambers of Commerce of all cities bordering on Lake Huron to consider purchase of the steamers of the Detroit and Cleveland Navigation Co., which have been plying between Detroit, Mackinaw City and intervening ports. The company are abandoning this service on account of the restriction of the Seamen's Act.

BUYERS' DIRECTORY

ARCHITECTS, NAVAL
John Reid & Co., New York.

ANCHORS
Thos. Davidson Mfg. Co., Ltd., Montreal, Que.
Hopkins & Co., F. H., Montreal, Que.
Taylor & Sons, S., Brierly Hill, Eng.

ANEMOMETERS
Taylor Instrument Companies, Rochester, N.Y.

ANVILS
Thos. Davidson Mfg. Co., Ltd., Montreal, Que.

ASH EJECTORS
Row & Davis Engineers, Inc., New York, N.Y.

ASH HANDLING EQUIPMENT
Dake Engine Co., Grand Haven, Mich.
F. H. Hopkins Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Row & Davis Engineers, Inc., New York, N.Y.

BAR IRON
Mitchells Ltd., Glasgow, Scotland.

BAROMETERS
Taylor Instrument Companies Rochester, N.Y.

BEARINGS, BRASS
Mitchell Co., The Robert, Montreal, Que.

BELLS, SHIPS, ENGINE ROOM, ETC.
Morrison Brass Mfg. Co., James, Toronto, Ont.
R. C. Miller Oil & Supply Co., Montreal, Que.

BELTING, RUBBER
R. C. Miller Oil & Supply Co., Montreal, Que.

BINNACLES
Hopkins & Co., F. H., Montreal, Que.
Morrison Brass Mfg. Co., James, Toronto, Ont.

BLOCKS, CARGO, HEEL AND TACKLE
Hopkins & Co., F. H., Montreal, Que.

BLOWERS
John Reid & Co., New York.

BLOWERS, TURBO-
Mason Regulator & Engin. Co., Montreal, Que.

BOAT RAILINGS
Canada Wire & Iron Goods Co., Hamilton, Ont.

BOILERS
W. M. Beardmore & Co., Montreal, Que.
John G. Kincaid & Co., Ltd., Greenock, Scotland.

BOILER CLEANING EXTRACT
R. C. Miller Oil & Supply Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
F. H. Hopkins Co., Montreal, Que.

BOILER COVERINGS
R. C. Miller Oil & Supply Co., Montreal, Que.
Crane Ltd., Montreal.

BOILER MAKERS
New Burrell-Johnson, Yarmouth, N.S.

BOILER MOUNTINGS
Jenkins Bros., Montreal.

BOILERS, MARINE
Can. Vickers, Ltd., Montreal, Que.
Doxford & Sons, William, Sunderland, England.
Engr. & Mach. Wks. of Can., St. Catharines, Ont.
Mason Regulator & Engin. Co., Montreal, Que.
Ross & Duncan, Govan, Scotland.

BOILERS STEAM
Engineering & Machine Works of Canada, St. Catharines, Ont.
New Burrell-Johnson Iron Co., Yarmouth, N.S.

BOOKS, TECHNICAL, MARINE
MacLean Publishing Co., **Toronto, Ont.**

BOLTS
London Bolt & Hinge Works, London, Ont.

BROKER
Page & Jones, Mobile, Ala., U.S.A.

BRASS GOODS
Crane Ltd., Montreal.

BREECHINGS
Engineering & Machine Works of Canada, St. Catharines, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

BUCKETS, CLAMSHELL
British Manufacturers Corporation, Vancouver, B.C.

BUCKETS, DUMP
British Manufacturers Corporation, Vancouver, B.C.
MacKinnon Steel Co., Sherbrooke, Que.

BUCKETS, COALING
British Manufacturers Corporation, Vancouver, B.C.
Engr. & Mach. Wks. of Can., St. Catharines, Ont.
Hopkins & Co., F. H., Montreal, Que.

CABLE
Canada Wire & Iron Goods Co., Hamilton, Ont.
Hopkins & Co., F. H., Montreal, Que.

CABLE, ACCESSORIES
Darling Bros., Ltd., Montreal, Que.
F. H. Hopkins Co., Montreal, Que.

CAPSTANS
Dake Engine Co., Grand Haven, Mich.
Hopkins & Co., F. H., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

CASTINGS
Kennedy & Sons, Wm., Owen Sound, Ont.
Midland Engine Works Co., Midland, Ont.

CASTINGS, GREY IRON, MALLEABLE, ALUMINUM
Darling Bros., Ltd., Montreal, Que.
Engr. & Mach. Wks. of Can., St. Catharines, Ont.

CASTINGS MARINE
Engineering & Machine Works of Canada, St. Catharines, Ont.
Midland Engine Works Co., Midland, Ont.

CHAINS
Hopkins & Co., F. H., Montreal, Que.
Taylor & Sons, S., Brierly Hill, Eng.

CENTRIFUGAL PUMPS
W. M. Beardmore & Co., Montreal, Que.
Mason Regulator & Eng. Co., Montreal, Que.

CHANDLERY, SHIP
Hopkins & Co., F. H., Montreal, Que.

CLOCKS
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Mason Regulator & Eng. Co., Montreal, Que.
Morrison Brass Mfg. Co., James, Toronto, Ont.

COAL
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

COCKS, BILGE, DISCHARGE, INDICATOR,
Morrison Brass Mfg. Co., James, Toronto, Ont.

COCKS, BASIN
Mitchell Co., The Robert, Montreal, Que.

COMPOSITION
Websters, Ltd., Hull, England.

COMPASSES
Taylor Instrument Companies, Rochester, N.Y.

COMPRESSORS, AIR
Darling Bros., Ltd., Montreal, Que.
Hopkins & Co., F. H., Montreal, Que.

OMPOSITION FOR SHIP'S BOTTOM
Websters, Ltd., Hull, England.

CONDENSER COILS
The Superheater Co., Ltd., Montreal.

CONDENSERS
Darling Bros., Ltd., Montreal, Que.
Kirkaldy, John, Ltd.
MacKinnon Steel Co., Sherbrooke, Que.

CONDENSERS, AMMONIA
Kirkaldy, John, Ltd.

COILS, AMMONIA
Kirkaldy, John, Ltd.

CONVEYORS, ASH, COAL
Hopkins & Co., F. H., Montreal, Que.

COUNTERS, REVOLUTION
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Mason Regulator & Eng. Co., Montreal, Que.

CLINTON FABRIC RE-INFORCING) CEILINGS, METAL

CRANES
British Manufacturers Corporation, Vancouver, B.C.
Hopkins & Co., F. H., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

CRANES GANTRY PORTABLE, JIB
MacKinnon Steel Co., Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton, Ont.

CRANK SHAFTS
Canada Foundries and Forgings, Welland, Ont.

DAVITS, BOAT
Hopkins & Co., F. H., Montreal, Que.

DERRICKS
Dake Engine Co., Grand Haven, Mich.

DISTILLERS
Row & Davis Engineers, Inc., New York, N.Y.
Kirkaldy, John, Ltd.
Mason Regulator & Eng. Co., Montreal, Que.

DITCHERS
British Manufacturers Corporation, Vancouver, B.C.

DREDGES
British Manufacturers Corporation, Vancouver, B.C.
F. H. Hopkins Co., Montreal, Que.

DREDGING SLEEVE
John G. Kincaid & Co., Ltd., Greenock, Scotland.

DRILLS, AIR
Hopkins & Co., F. H., Montreal, Que.

DRY DOCKS
Can. Vickers, Ltd., Montreal, Que.
Montreal Transportation Co.
Doxford & Sons, William, Sunderland, England.
Georgian Bay Shipbuilding & Wrecking Co., Midland, Ont.
Yarrows, Limited, Victoria, B.C.

EJECTORS
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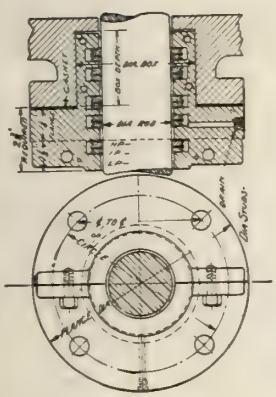
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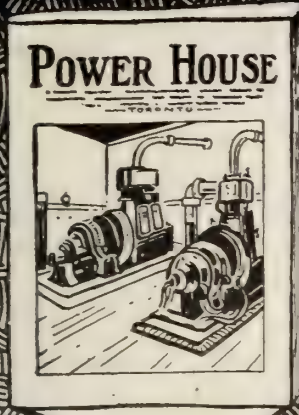

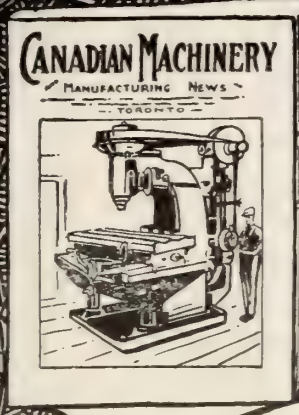

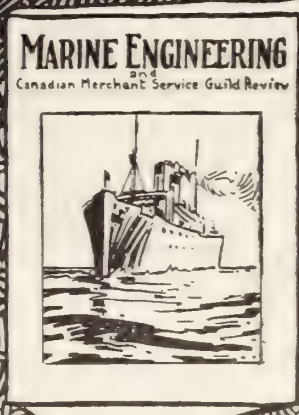

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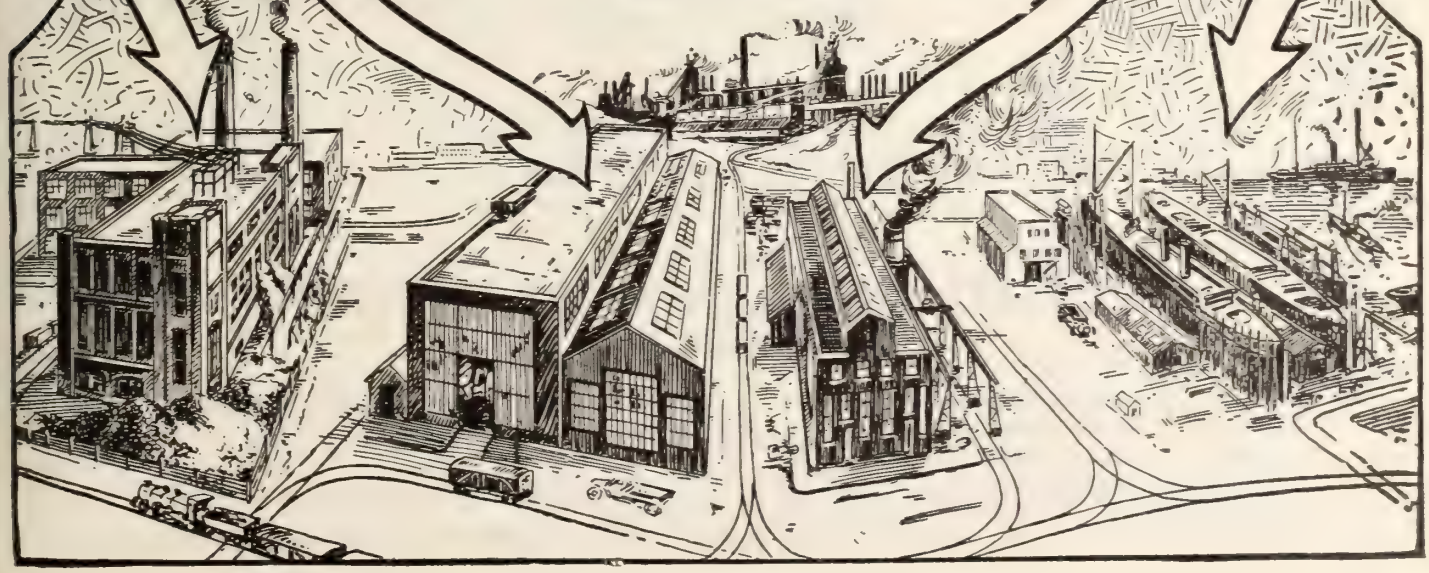

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(Sgd.) W. J. Mitchell,
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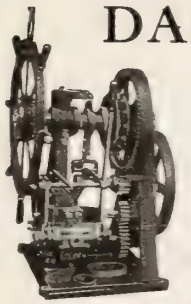

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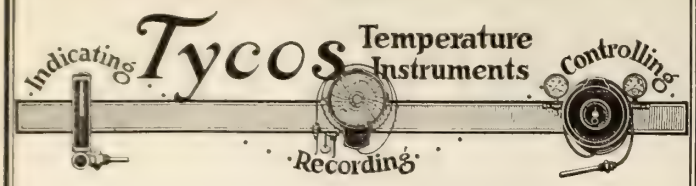

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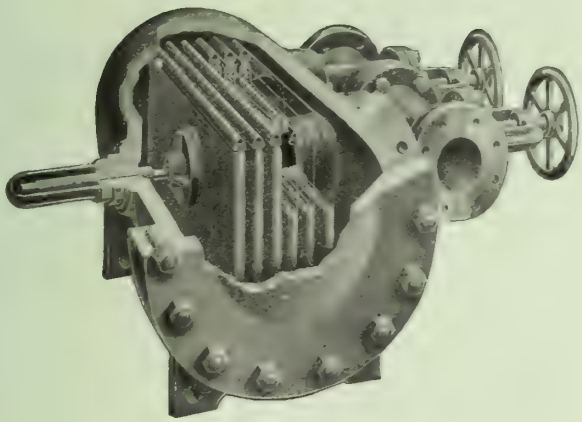

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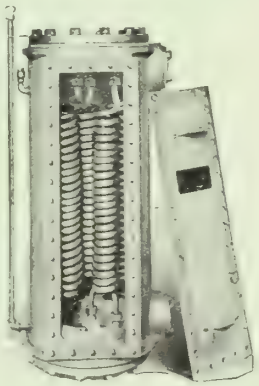

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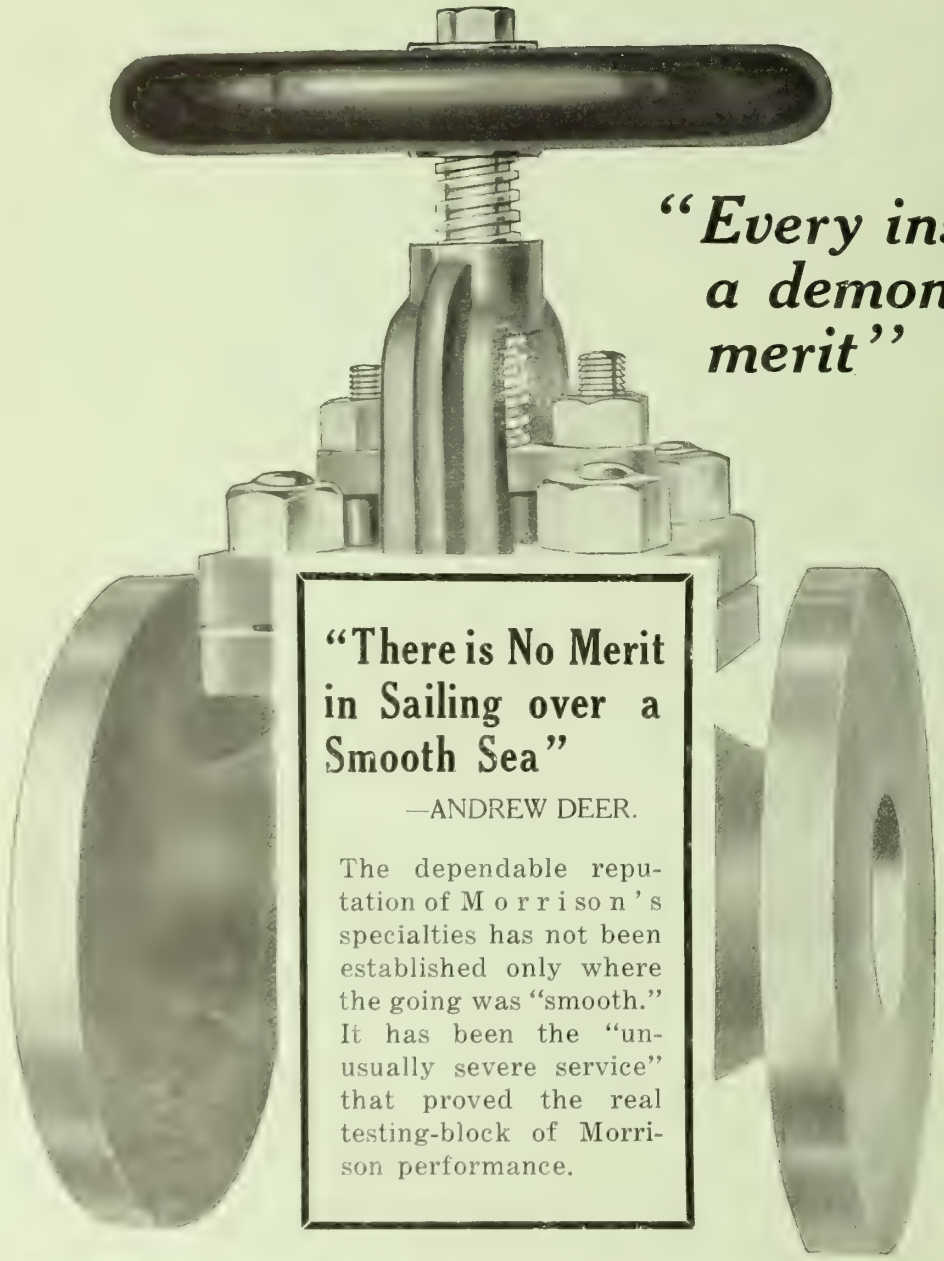

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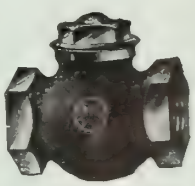

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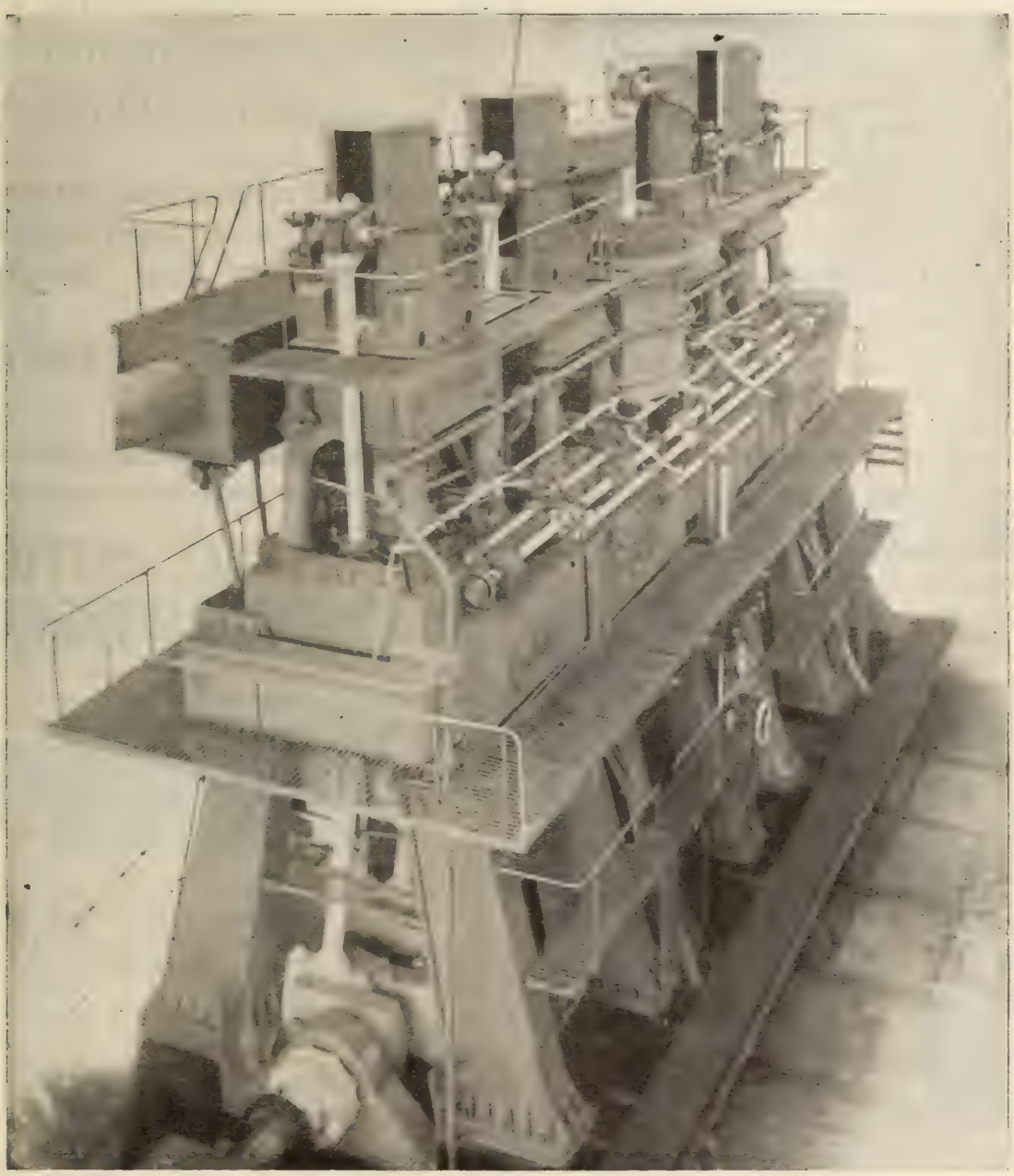

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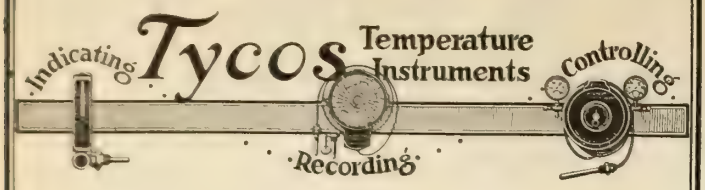

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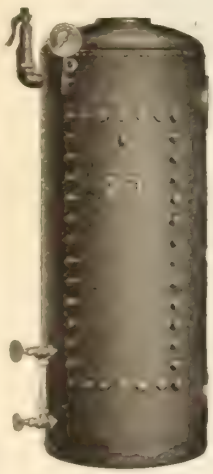

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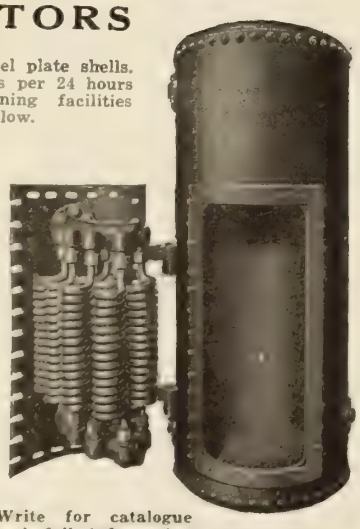

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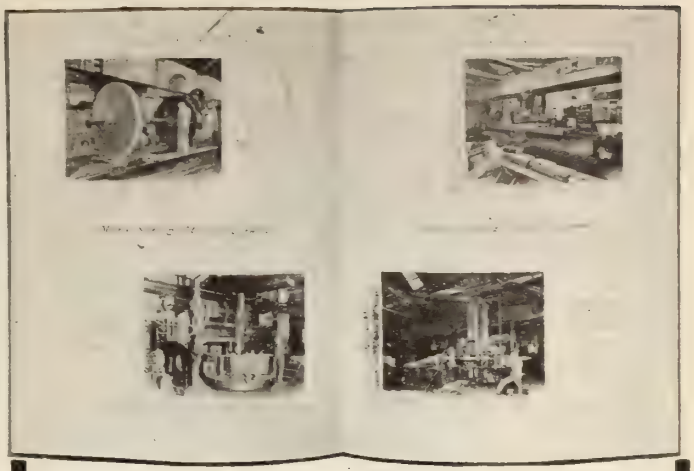

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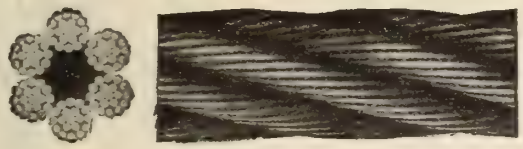

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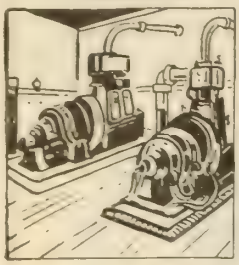

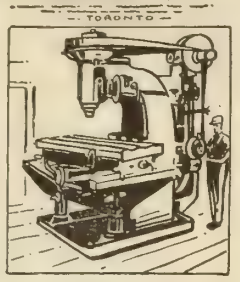

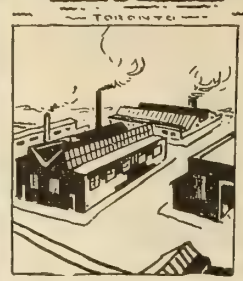

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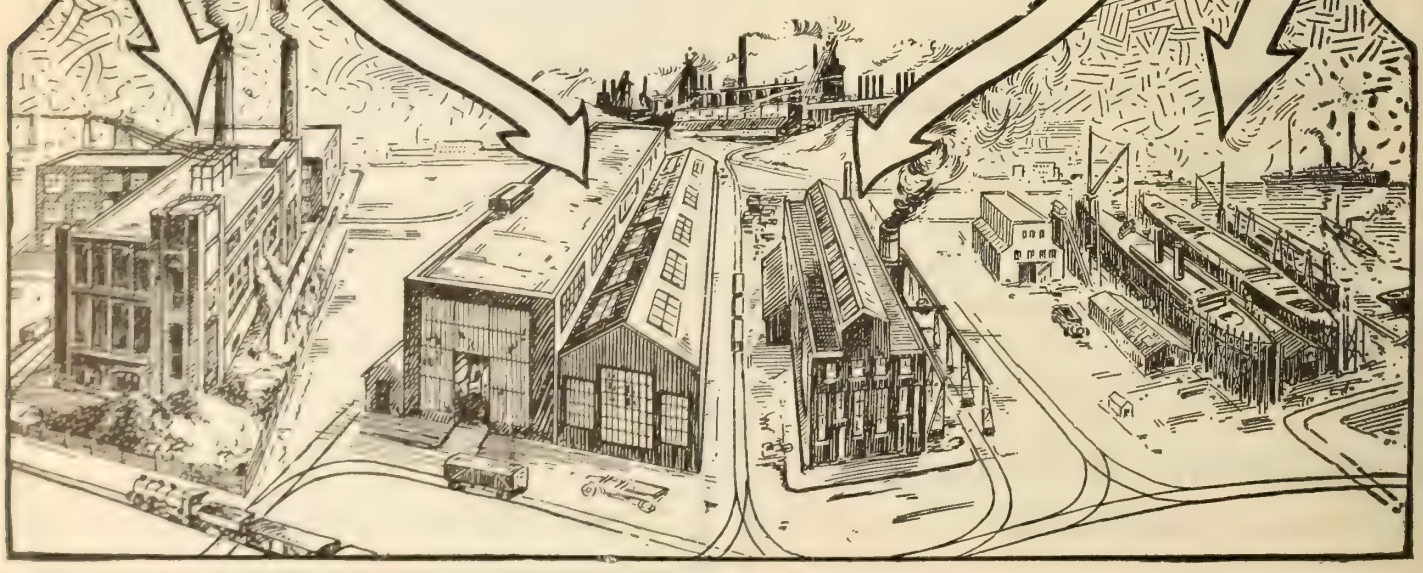

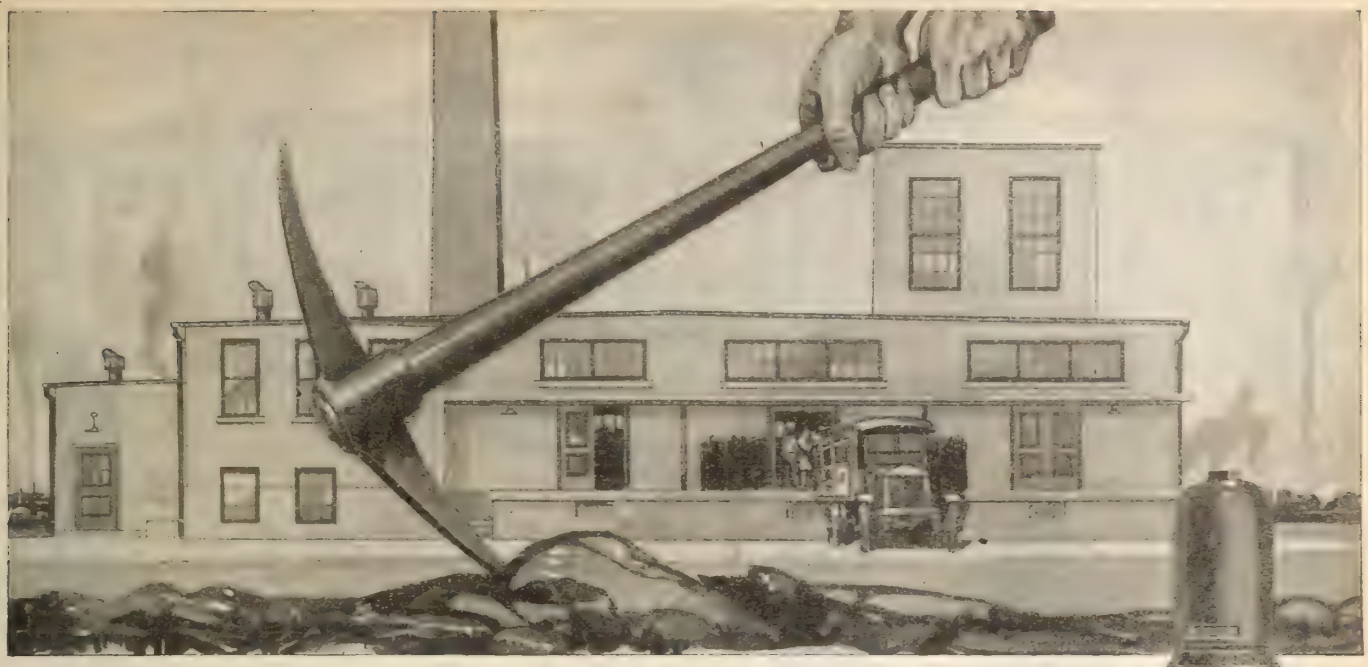

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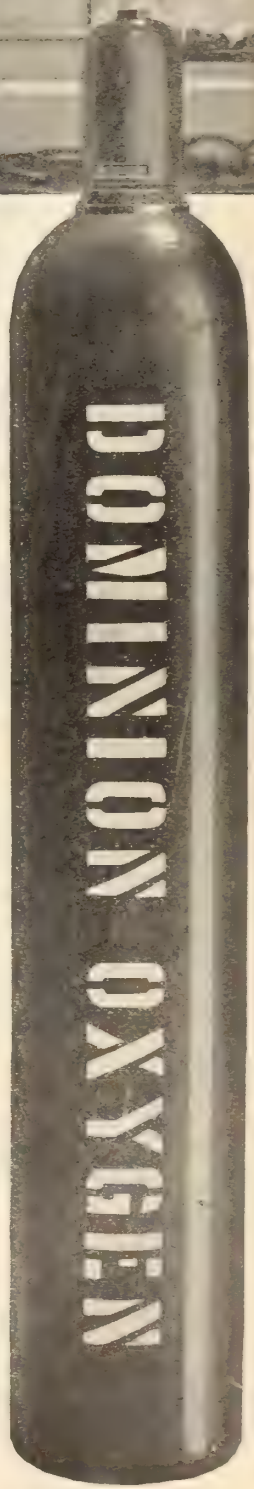

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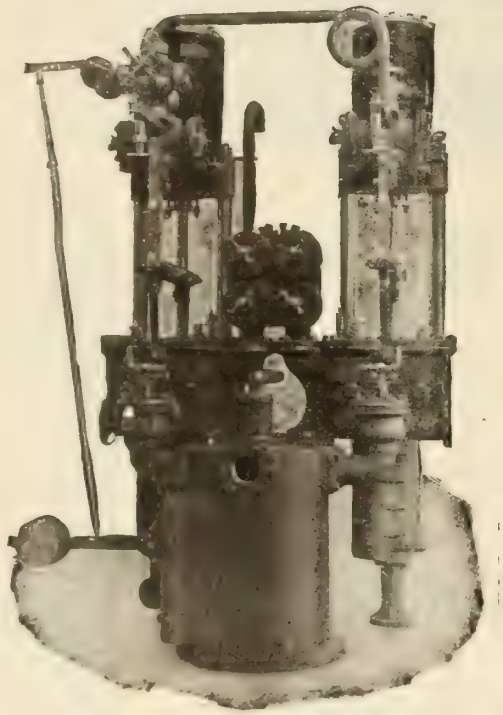

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MARINE ENGINEERING
OF CANADA

Volume XI SEPTEMBER, 1921 Number 9

A Short History of World Shipbuilding

Early Shipbuilding—Ship Framing—Standardization and the Fabricated Ship—Early Steamships—Special Purpose Vessels—Developments in Marine Engineering—Welding in Shipbuilding—Passenger Vessels—Canada As A Shipbuilder—The Early Engineer

By H. R. McLelland, A.M.E.I.C.

IN CONSIDERING, briefly, early shipbuilding, the writer will confine himself principally to British shipbuilding, in which, after all, we are probably most interested as a Canadian Institution.

The first historical record of British shipping is found about A. D. 973, and, so far as we know, the vessels in existence at that time were about fifty or sixty tons, single masted, and with one sail.

In 1066, a date which is surely engraved in the mind of every one of us, Harold gathered a fleet to repel the landing of William, later known as the "Conqueror." The Crusades gave an impetus to shipbuilding, as Richard, "The Lion Hearted," used vessels to transport his troops and horses to Palestine.

Early in the 13th century we find the first known record of the use of a compass, and about the year 1300 of the use of a rudder, vessels previously having been steered by oars on the sides and quarters.

It was not until about the time of Elizabeth that sailing vessels approached the type with which we are all familiar, and then, about the year 1800, steam was applied for propulsion. This was not the first introduction of steam power for this purpose, but it was not until 1800 or 1801 that the use of steam was seriously considered as a means of propulsion for traders and cargo carriers.

We have all heard of the clipper ships, and the years of the first and greatest fame extended from about 1840 to 1855. Great speeds were frequently obtained by these clippers, and few people, unless those who have studied the matter, realize what they were capable of doing in the way of speed. As examples, we have authentic records to prove that the ship "Flying Cloud" made a run (which was duly verified) of 433 nautical miles in twenty-four hours, or in other words, 18 nautical miles per hour, which approximates very closely the daily average of our best Atlantic liners of to-day. Another ship the "Sovereign of the Seas," is recorded as having made 419 miles in the same period of time, or 17½ miles per hour. It should be noted that these records were made entirely by sail power. Both these vessels were built in the United States.

About 1870 the great revolution in ship design and construction began, and the dimensions and tonnage of vessels increased by rapid strides. In addition, the use of sails alone was dispensed with more and more, and the use of steam increased, with the result, as we now know, that the grand old sailing ship, with all the romance and tradition which were attached to her, has gradually fallen into disuse, and is now looked upon, more or less, as a curiosity, except in certain special parts of the world, of which the coasts of Novia Scotia, New Brunswick and Maine are amongst the outstanding.

Early Steamships

Before leaving the ancient days, it will be of interest to recall that the first steamboat built in the North American Continent was the "Clermont" built by Robert Fulton in the United States, in the year 1807. Two years later, or about November 1809, the second steamboat constructed in the North American Continent was built at Montreal, by Mr. Molson. This vessel was known as the "Accommodation," and inaugurated a passenger service by water between Montreal and Quebec. Those of us who are apt to criticise existing facilities for travel should remember that this particular vessel took about 36 hours to make the journey between the two cities, doing so with the aid of an engine of about 6 horse power.

The change from the vessels mentioned, to the floating palaces of to-day is startling. We have emerged definitely from the vessel with restricted accommodation, small stuffy rooms below decks, the ever present smell of bilge water and attendant discomforts. Looking back over the period which we have been considering, one cannot help but be profoundly impressed by the wonderful extent of the developments which have taken place, whether one considers the general question of hull construction and arrangement, or whether one refers to the details of equipment and luxurious furnishing.

The introduction of the use of iron, and later on of steel, revolutionized ship construction, and made possible the leviathan of to-day. It has also made possible a high degree of specialization in types, to satisfy the different trades. This is evidenced by the development, as compared with the old type cargo vessel, of the present day vessels for the carrying of bulk cargoes such as meat, grain, and oil.

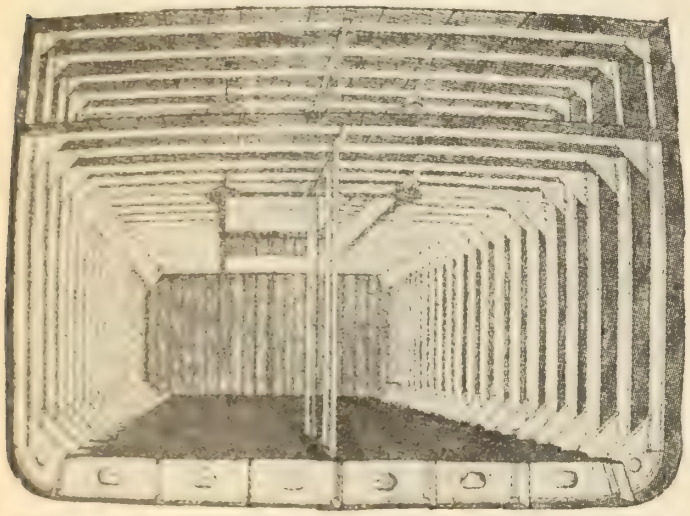
Ship Framing

In the main, present day ship construction is divided into two basic systems, one the transverse framing and the other longitudinal framing the latter system being used, almost exclusively, in the construction of vessels intended to carry what are known as bulk cargoes.

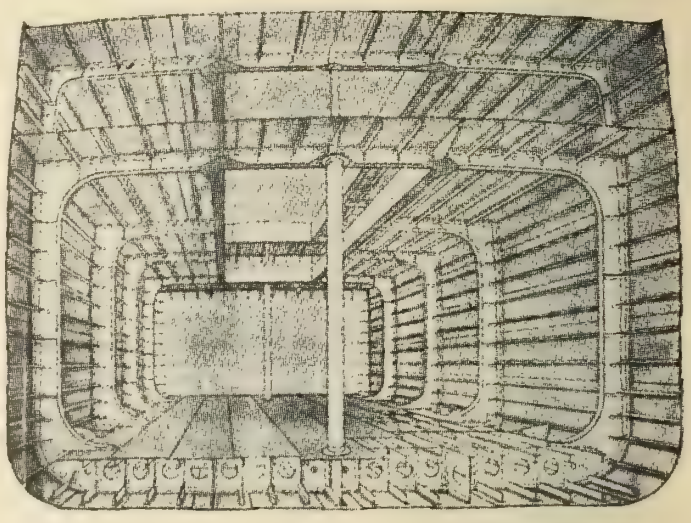
For many years naval architects have devoted their energies to scientific research into the subject of stresses and strains to the end that unnecessary weight might be dispensed with and strength retained where most required. By so doing, the carrying capacity of the modern steamship has been enormously increased, without, in any way detracting from her strength or seaworthiness, and it is now apparent that, in the early days of ship design, vessels were constructed vastly heavier than was really necessary. The merits or demerits of the design of a cargo vessel are largely dependent upon two features—one suitability for the specific purpose for which she is intended, and the other the cost of construction. To-day we feel that we have about reached the pinnacle of the economical construction of steel vessels. That the feature of the suitability of design is being properly looked after is well substantiated by the fact that a vessel of 10,000 tons can now be built with holds more free from obstruction and with greater facilities for

working cargo than a 4,000 ton vessel of twenty-five years ago.

Let us consider first, the general cargo carrying vessel. The consensus of opinion among experts in ship handling and operation is in favor of a vessel of about 8,800 tons deadweight carrying capacity, including coal and stores. One outstanding type of vessel of this size is known topically, as the "Robert Dollar" type, for the reason that about the first of this type was built on the Clyde, to the order of the well known West Coast Shipowner of that name. So suitable was this type for general cargo carrying purposes, that it was adopted as a standard by the United States Shipping Board. These vessels are about 410 feet 6 inches long by 54 feet broad by 29 feet 9 inches deep, being built on the transverse framing system. One of the types built by the Canadian Government which is practically a duplicate of one of the British standard types is very similar to the "Robert Dollar" type" being about 500 tons less in deadweight carrying capacity. Vessels of these types were built in large numbers during the last five years, being propelled by either reciprocating or geared turbine engines.



Single deck cargo vessel designed on ordinary transverse system with no side stringers. Dimensions 399 ft. x 50 ft. 8 ins. mld. x 28 ft. 3½ ins. mld.



Single deck cargo vessel. designed on the longitudinal system. Dimensions 399 ft. x 50 ft. 8 ins. mld. x 28 ft., 3½ ins. mld.

Standardization and the Fabricated Ship

During the war it was in connection with the general cargo carrying vessel that the principles of multiple production, and what is known as fabrication, were for the most part applied. This was done to a much greater extent by the United States than by any other country, probably for the reason that the United States had only a comparatively small amount of experienced shipbuilding labor in proportion to the magnitude of the programme of building ships upon which that country embarked.

In Great Britain, the advent of the War necessitated a certain amount of standardization in the types of ships constructed, this being a direct contradiction of the established principles of British shipbuilders and shipowners. British shipowners in the past, by virtue of their enormous experience, have decided for themselves the particular type of vessel which they have desired and which they knew would be the most suitable for their own trade. In fact, one well known British shipowner has made the statement that the real great step forward in the development of the British Mercantile Marine was made when the shipowner began to stipulate to the shipbuilder the type of vessel he required to be built. Whether that is true or not does not matter, though it is a fact that in no country have the owners of ships demanded closer attention to their own ideas from ship designers and builders than they have in the United Kingdom.

During the war this practice had to be dropped and standardization introduced. To-day, however, standardization is almost entirely discarded, and shipowners, particularly British shipowners, are now once more going out for the vessels which meet their own particular requirements.

The standardization of types, which reached its pinnacle in the United States in 1918, made possible the advent of the fabricated ship. Standardization and the resulting use of the fabricating principle made it possible for practically all the steel entering into the construction of large numbers of vessels to be prepared for erection in the ship, in some cases thousands of miles from the place where the ship was being built. Futhermore, this practice distributed employment broadcast and utilized practically all workshops in the country which were in any way equipped to handle steel. In addition, parts of the equipment of vessels were manufactured in the most out of way places, for instance, engines were built in Colorado for ships being built in Georgia. In Great Britain the same practice obtained but to a lesser degree owing, principally, to the unrelenting and hidebound attitude of the British Trades Unions, and the stand they took on the questions of demarcation between different trades and what was known as dilution of labor. The War was directly responsible for the recrudescense of the building of wooden ships. Not the old type windjammer to which our thoughts turn when we think of wooden vessels, but steamers ranging from 3,000 to 4,000 tons deadweight carrying capacity. These wooden vessels have been a failure principally owing to the fact that the use of unseasoned lumber and the inexperience of the men who built the vessels were coupled with the use of heavy machinery with its inevitable vibration. In any case, the construction of wooden vessels of large size and with heavy propelling machinery can only be termed an emergency effort and all credit should be given to those who produced them in such large numbers during the War, even though when completed they were so far from being successful. As one critic remarks, "the spirit was willing, but the timbers were unseasoned."

Before leaving general cargo vessels, it might be mentioned in passing that the much discussed concrete vessel which gained world wide prominence during the late years of the War, has now, for the most part, gone out of existence except for barges and such uses. The opinion of the vast majority of shipping men is, that there is no commercial future in concrete vessels as ocean-goers, as records show when over 100 feet in length a concrete vessel is heavier than a wooden or steel vessel of similar size, and as a ship is built to carry cargo, everything which detracts from her carrying capacity is an economic loss.

The preceding remarks apply to what we call the general cargo vessel which, in brief, is a vessel designed and constructed so as to be capable of transporting, with reasonable economy, cargoes of almost any description.

Special Purpose Vessels

Vessels which are employed in a regular specific trade are usually specially

designed for that trade. For instance, vessels in the coal and ore trades have self trimming hatches and topside ballast tanks and, in the case of vessels engaged in these trades on the Great Lakes, the hatches are arranged to be at the same centres as the chutes ashore on the docks. The advantage of building vessels specially for such trades is evidenced by the fact that, on the Great Lakes, a 10,000 ton vessel has been loaded with a full cargo of ore in twenty-three minutes, the average time for loading a vessel of this size being from one hour to one hour and thirty minutes. A 10,000 ton ship can be loaded with coal in from five to six hours, and a record has been made in unloading one vessel with 10,073 tons of soft coal on board in six hours and thirty-five minutes.

The transporting of frozen and chilled beef has necessitated the development of a very special type of cargo vessel, and this development has taken place within the last forty years. The first vessel to carry a cargo of frozen meat to Great Britain was the "Strathleven," and this was in the year 1881, the cargo being 34 tons. Today there are over 300 vessels under the British flag fitted for the carrying of chilled beef, and the last available figures we have were in 1913 when 730,000 tons were imported into Great Britain.

Owing to the large amount of special equipment, insulation, etc., required on a vessel of this class, and also owing to the method in which such cargoes must be carried the largest chilled meat carrier afloat to-day only carries 4,700 tons in her cold chambers. As a general cargo carrier the same vessel would carry about 10,000 tons. It is interesting to know that practically the whole of the world's carrying trade in chilled and frozen meats is performed by ships under the British flag.

The United Fruit Company runs a fine fleet of steamers, some of these being in the perishable fruit trade. Most of these ships are registered under the United States flag, but, apart from this company, the fruit carrying trade is also largely under the British flag. This, of course, is due primarily to the extensive foreign and tropical possessions which are held by the United Kingdom.

Some of the later units of the Canadian Government fleet have been equipped in a small way with refrigerating machinery for cargo purposes, being capable of carying about 200 tons of chilled meat.

We are all interested these days in the transporting or, at least, in the using of oil. In no branch of ship-building have greater strides been made than in the specialized vessels for the carrying of oil in bulk. The first tank steamers, it is interesting to recall, were simply converted cargo vessels, internal tanks being fitted to contain the oil, the latter not being in contact at any point with the structure of the hull. During the War this principle of using internal tanks was very extensively adopted, because oil was an imperative necessity to our carrying on of the war and tank steamers, so called, were hopelessly few. The result was that general cargo steamers had to be converted, in large numbers, into oil carriers.

The oil tanker, designed and built purely and solely for the carrying of oil in bulk, is a very special product of the ship designer's art. In fact many shipyards have been disinclined to go into tanker construction, because of the many difficulties such construction presents. In an oil tanker, or indeed any vessel used for the carrying of bulk and particularly bulk liquid cargoes, longitudinal strength is the prime factor. This factor has been well taken care of by the adoption of what is known as the longitudinal system, developed to a great extent by J. W. Isherwood, the inventor of the "Isherwood System" of ship construction.

There are many points of difference between what is called the transverse system and the longitudinal system, but the main feature is, that in the transverse system, the frames or ribs of the vessel run in a transverse or thwartship direction, whereas in the longitudinal system they run longitudinally or fore and aft. There are many other technical differences which need not be elaborated upon in a paper of this kind.

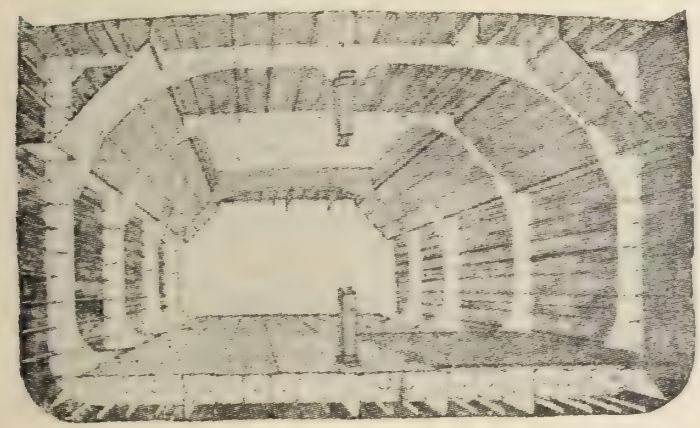
Oil tank vessels are, as already stated, very carefully built and necessarily so. It is well known that oils, particularly petroleum, respond readily to change in temperature and modern oil tankers are constructed with expansion trunks on all tanks. These trunks permit the oil to expand and as they are built to some height above the tank top level, they also permit the oil to contract without the level of the top of the oil getting below the level of the top of the tank itself. Such a condition would produce what is called a "slack" tank, which is a potential source of danger when a vessel is in a seaway, and which is apt t cause leakage by disturbing the riveting and caulking.

The largest oil tanker afloat to-day has a carrying capacity of 18,000 tons, and vessels to carry 20,000 tons are now in course of construction.

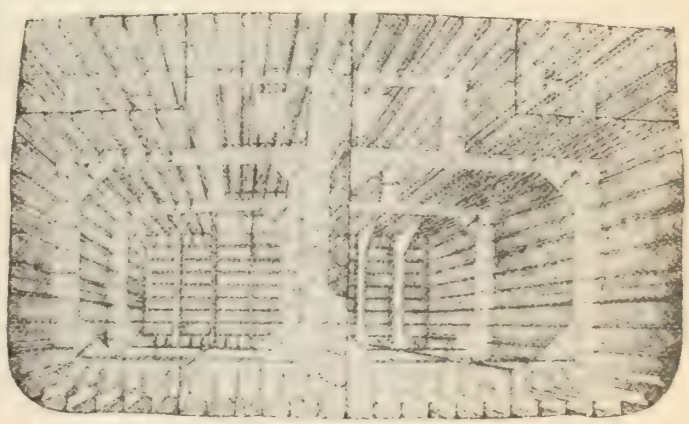
Passenger Vessels

World shipbuilding has made no greater strides than in passenger vessels. It would be superfluous to go into detail about the equipment, so far as passenger comfort is concerned, of the present day liner, or even of the smaller passenger boat. We have all been amply familiarized with the craze which calls for elaborately decorated public rooms, private suites with a reserved portion of the deck as an additional inducement, swimming baths, etc. All these wonders of the shipbuilders' and ship-decorators' arts have resulted in giving us to-day a truly luxurious means of ocean travel, the only consideration being the cost.

It may be stated here that it is questionable if any more of these floating palaces will be constructed for many years to come. Such enormous vessels require enormous crews and call for high operating costs, little or no space is devoted to cargo, and therefore the only revenue is from the passengers. All evidence goes to show that these ocean leviathans can not be made to pay, and no one, not even the shipowner, can afford to operate at a loss. Consequently, the tendency to-day is toward the one class boat, or the two class boat, of smaller dimensions and with considerable cargo carrying capacity. The multi-millionaire may still crave for his lux-



Single deck colliers Rose Castle and Lord Strathcona, built on the longitudinal system. Dimensions, 455 ft. x 57 ft. 9 ins. x 33 ft. 9 ins. mld.



Oil tank steamer designed on the longitudinal system. Dimensions 420 ft. x 54 ft. 6 ins. x 32 ft. 9 ins. mld.

uries, but, from present indications, the shipowner, particularly the trans-oceanic shipowner, is going to cater, in the future, to a larger element of the travelling public.

For this reason, unless the costs of operation are revolutionized by some new development, it is to be doubted whether this generation will see any more "Aquitanias" or "Olympics" constructed. The records of the White Star Line, so far as the profits on individual ships are concerned, would probably, almost certainly, confirm the poor earning qualities of the vast passenger liner of to-day. Compare the "Olympic" of 46,000 gross tons with the "Adriatic" of 24,500 gross tons. There is hardly a doubt that the latter vessel is a profit maker, whereas it is very questionable if the "Olympic" can be run without a loss. Anyone who has travelled on both the vessels named will confirm that the "Adriatic" is really the more comfortable ship, is a good sea boat, and has all the luxuries the ordinary man desires. Other similiar comparisons might be made, and it is needless to say that the shipowner must inevitably stake his money on the type of vessel which will bring him in the greatest returns.

The construction of the hugh liners such as the "Aquitania," "Imperator" and "Vaterland" was the result, to a great extent, of a competition between Great Britain and Germany for the blue ribbon of the Atlantic,—surely the most costly ribbon for which nations or individuals ever competed. The present condition of national finances precludes, for many years, a resumption of these competitions.

At one time ships were far ahead of all existing harbor facilities, particularly as regards draft. Now that has been changed. Generally speaking, channels and canting spaces are ample in depth and width for the vessels they are called upon to accommodate. The building of vessels 1,000 feet in length and over while not at all impossible, is, as has been stated, improbable, and, therefore, the existing drafts of channels, if maintained, should be ample for many years to come. In all probability when tha time does come and more leviathans of the deep sea are called for, the use of air craft may have developed to such an extent that the thoughts of transportation and terminal men will be directed to hangars rather than to wharves and freight sheds.

Intentionally this paper has not contained, so far, many figures or statistics, but, before passing on to consider very briefly the other side of the ship construction business, that is marine engineering, it may be interesting to know that during the year 1920, a total of 3,233 vessels having a total tonnage of 6,884,875 and a total Indicated Horse Power of 6,097,780 were added to the world's floating equipment. This was a drop of about 927 vessels, of about 1¾ million tons and of about 3 million Indicated Horse Power from the totals of the preceding year.

Welding in Shipbuilding

No paper on shipbuilding, however general, would be complete without a reference to the part which welding, both oxy-acetylene and electric, has played in the last few years. It is not so long ago since we heard of the great welding jobs performed by the French, Swedes and Germans with admiration and wonder. The French were the pioneers in welding by the oxy-acetylene process, and as far back as 1907 had a plant at Lyons which was really the home of the industry. To that plant several men from Great Britain were sent and were trained, returning to Great Britain and establishing the industry there. To the Scandinavian countries and Germany must be given much of the credit for the advance in the electric welding process. It is perhaps, unpleasant, but none the less true that in British repairing plants as late as 1912, practically all the electric welding was done by foreigners, either Germans or Scandinavians. Later on, of course, local men became educated and electric welding, which has now almost superseded for all general purposes all other methods, has become so general that it is commonplace. Whereas up till four or five years ago welding was confined, so far as ships are concerned, almost entirely to boiler repairs, now we find the electric welder at hundreds of small jobs all over the ship. For the most part his services are only called for where strength is not a great consideration, and where the main idea is just to fill up. This may be unjust prejudice on the part of ship men, but there it is. In spite of this prejudice the so-called welded ship has become an actuality, and one vessel which was completed during the year 1920, by the firm of Cammell Laird & Company of Birkenhead, England, has attracted a great deal of attention in shipbuilding circles. Not only is this vessel, the "Fullagar," electrically welded throughout, but she is also fitted with an internal combustion engine of a novel type.

It is useless to speculate as to the future of the application of welding to ship construction. Much has already been done, extensive researches have been carried out and the advancement today, as compared to five years ago, is marvellous. In these days of rapid development, he is a foolish man who condemns utterly anything which is novel or which, at first sight, appears to him impractical. It may seem a flight of the imagination to consider the building of a huge ocean-going vessel entirely without rivets. Obstacles which seemed just as impossible and impractical at one time, have been attacked and the difficulties surmounted, so we must be careful in our statements as to the future possibilities of any new idea which, at the moment, may seem to us to be little better than experimental.

Development in Marine Engineering

On the purely engineering side of ship construction, there have been immense strides within recent years. The marine steam engine has passed through a gradual evolution, commencing with the single cylinder simple engine and passing through the successive stages of compound, triple expansion and quadruple expansion. The simplicity and reliability of the ordinary reciprocating steam engine, make it, even in these advanced days, probably the most satisfactory unit for propelling the ordinary medium sized vessel.

Turbines have been very extensively adopted for ship propulsion particularly in high powered and fast passenger steamers. It has been said that if a vote were taken amongst those interested in British shipping as to who conferred the greatest good upon the industry as a whole, the vote would be in favor of "Parsons," the inventor, or at least the adaptor to commercial uses of the steam turbine.

Turbines are in common use on board steam ships in various ways:

(1) All turbine drive with the turbines directly connected to the propeller shafting.

(2) The combination, where turbines are used in conjunction with ordinary reciprocating engines, the exhaust steam from the low pressure end of the latter, being passed into a turbine where the last remnants of its expansive properties are utilized before finally reaching the condensing plant.

(3) The system in which turbines drive the propeller or propellers through specially designed and constructed gearing either of the single or double reduction type.

(4) The electric drive in which the turbines are used for the generation of electric current which, in turn, is used to drive the propeller shafting through motors.

Our neighbors in the United States, have, in the last couple of years, become very enthusiastic in the use of electric drive. Several units of the United States Navy are propelled by electric machinery, and, within the last few months, some cargo vessels have also been fitted with this type. Though the results so far have been satisfactory, we are scarcely in a position to say whether or not electric drive for ocean-going cargo or passenger vessels is a commercial success, as, owing to the peculiar conditions under which ships operate and the sudden emergencies they, and those on board of them, are frequently called upon to face, it is only by long experience that the merit or otherwise of this method of propulsion can be determined. Naval vessels, are, of course, in a class by themselves.

Within the last decade, the use of oil as fuel on board vessels has increased by leaps and bounds. According to last

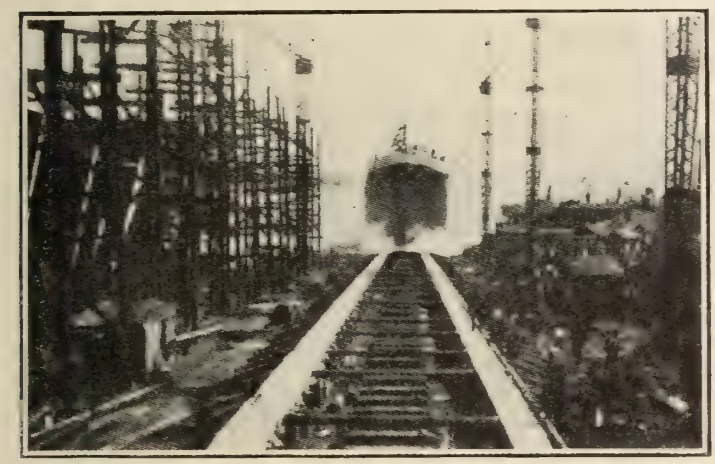
year's records, the number of vessels afloat using oil in oil-fired boilers is 16.3 per cent, and of those using oil in internal combustion engines 1.7 per cent. Of the remaining world tonnage of size above 100 tons, 76 per cent use coal as fuel, and 6 per cent have sail power only.

There are many adherents to-day to the use of Diesel and semi-Diesel type engines on board ships. Personally, the writer is of the opinion that the development of this type of machine for marine purposes is one of the most outstanding achievements of recent years. There are many arguments put forward by the supporters of this type of propulsion, most of which are reasonably sound. Lord Pirrie, the world renowned head of Harland and Wolff, and a magnate of shipbuilding and engineering, after making a tour of oil fields in the Southern States and Mexico, suggested that it was almost a crime for any power user to consume oil in oil-fired steam boilers or in any other manner than directly in a motor engine. Decided advantages accrue by the use of internal combustion engines in the way of increased deadweight capacity (owing to the absence of boilers), economy in fuel, upkeep and personnel.

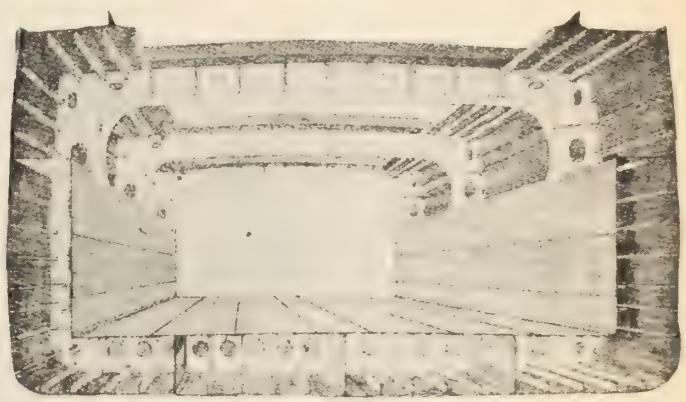
Comparing steam engine driven vessels with internal combustion engine driven vessels, one is forced to admit the advantage in favor of the latter. From established records it is known that the most efficient steam-driven turbine and geared machinery of say 3,000 shaft horse power will not consume less than one pound of oil per shaft horse power per hour for all purposes, whereas with an internal combustion engine driven ship of equal power utilizing an economical system of auxiliary driving, the figure is less than ½ pound of oil per hour per shaft horse power for all purposes, a saving of at least 50 per cent.

Taking a vessel equipped with a Diesel of say 4,000 Brake Horse Power, the oil consumption in pounds per hour per horse power is about .45. A reciprocating engine of about 4,700 I.H.P. would be required for the same vessel, if using coal the consumption would be about 1.6 pounds per horse power and oil about 1.14 pounds per horse power per hour. A geared turbine of about 3,900 shaft horse power would require 1.4 pounds of coal and 1.0 pounds of oil per horse power per hour. The nearest competitor to the Diesel with its.45 pounds of oil per hour per horse power is thus the geared turbine with its 1.0 pounds of oil per hour per horse power.

A great revival has taken place in regard to Superheating. It is rather surprising to remember that the steamer "Great Eastern," that famous product of the brains of Brunel and Scott Russel, which was built in 1858, was equipped with Superheaters. For many years after the "Great Eastern," Superheaters on board ocean-going vessels seem to have fallen into disuse, until the revival of seven to ten years ago. Since then the use of Superheaters has increased enormously, and to-day many different types, all with advantages and some with disadvantages, are in use. It seems now as though the advantages and economy of superheating steam were beyond doubt and the use of some kind of superheating equipment is gradually becoming universal.



Launching of the S.S. "Canadian Marine" at Halifax.



Great Lakes freighter, W. Grant Morden, built on the longitudinal system. Dimensions, 604 ft. x 59 ft. x 32 ft. mld.

The Old-Time Engineer

We must, however, never lose our respect and admiration for the old type engineer, immortalized by Kipling, who succeeded in keeping his machinery running when it seemed physically impossible for him to do so. Covered with oil from head to foot, usually involved in arguments with firemen or trimmers, McAndrew was a type by himself, full of resource and frequently on the lookout for vacuum, which seems to have been the bane of the engineer Kipling portrays. In the midst of all our new ideas, let us not forget the foundation laid by the old timer, with his compound engine and low pressure boilers. The intimate knowledge of his machine which he possessed has borne such fruit that, to-day, we find very strong prejudices against the adoption of, what we are pleased to call, more modern equipment.

Admiral Lord Charles Beresford, whose memory is dear to everyone with British blood in their veins, once made the following comments on the old sailing navy, and his remarks apply equally well to the Mercantile Marine, even in these days of steam and oil—"The Navy provides the finest possible mental and physical training. It teaches initiative, presence of mind, accurate observation, habitual defiance of danger, ready resource and an extraordinary hardihood. At sea a man holds his life on the condition that he possesses these qualities. Frequent emergencies are part of the ordinary routine, and the penalty of failing to meet them is inevitable. There is no arguing with a gale of wind."

Canada as a Shipbuilder in the War

Canada has played a great part in establishing herself as a definite partner in the great business of World Shipbuilding. From sources which are considered reliable, we learn that in 1863 a total of 602 vessels with a tonnage of almost 225,000 tons were constructed in Canada, including the Maritime Provinces. It is evident that in those days this country did quite a large business in the building of ships and selling them to other countries. In 1874 the number of vessels constructed had dropped to 487 with a tonnage of 190,000, and from that time on, the fall was gradual until in 1915 the number was only 246, with a tonnage of about 19,000 tons. The use of iron and steel in the construction of vessels was largely responsible for the shrinkage in Canada's output, as, until a few years ago, iron or steel shipbuilding was a very small factor in the country's business.

In certain sections of the Maritime Provinces and Pacific Coast, wood shipbuilding is still quite an important industry, but the tonnages turned out are small and do not mean much in tables of statistics.

The needs of Canada and the Mother Country in the war made the development of the shipbuilding industry in Canada a very real and vital necessity. Now that we have been placed in possession of some actual facts regarding the war situation, it is undoubtedly proved that the crux of the whole affair lay on the sea, and that, if the submarine

campaign had gone on unchecked and had achieved that success which, at one time, it seemed almost certain to achieve, there could only have been one ending.

Canada constructed in, for the most part, newly developed Canadian shipyards a large number of patrol vessels, the first being delivered in October, 1917. A total of sixty trawlers and one-hundred drifters were constructed, and these vessels rendered yeoman service in patrolling duties in Canadian waters and in other parts of the world. In addition, large numbers of submarines, motor driven scouts, etc., were built in this country and used in various zones of warfare. The Davie Shipbuilding Company, at Quebec, constructed a fleet of about fifty light draft barges for Mesopotamia. These were taken apart at Quebec and re-erected in Mesopotamia and proved so satisfactory that Lord Allenby, the General in command of the Eastern campaign, wrote Mr. Davie a personal letter complimenting him on the work the plant had done, stating that the Canadian built boats had been the best of all the boats sent over.

The Imperial Munitions Board carried through an extensive programme of ship construction which resulted in the completion of much useful cargo carrying tonnage during the later years of the war.

There has been a great deal of talk about the Canadian Government Merchant Marine. The writer is not a politician, and is therefore for that reason not much exercised as to the wisdom or otherwise of this Government owning a Merchant Shipping fleet. This fine fleet was projected in the darkest days of the war, and vast sums of money were invested in shipyards and allied industries in order to construct and to deliver the Government cargo carrying vessels for which the whole world, at that time was clamouring. The total cost of the whole Government programme of sixty-three ships of about 380,000 tons deadweight is around $72,818,000,00, or, in other words, the cost to Great Britain of about two days warfare as practised in the year 1918. The cost per deadweight ton ranged from $167.50 to $215-00, according to size, and these were fair average prices at the time the orders were placed.

The Future of Shipbuilding in Canada

To-day about fifty ships are in actual operation. They may not all be making money, but it would be no disgrace to the men who are operating them if they were not making money under the present conditions of freights and international commerce. Everyone of these fine, well designed and well built vessels has the word, "Canadian" as a part of her name, and therefore acts, in some measure anyhow, as a means of propaganda for this growing country. The writer has been very proud on different occasions to see in New York Harbour, a Canadian owned, Canadian designed, Canadian built and Canadian operated vessel flying the Canadian flag at her stern, a worthy example of the strides Canada has made in ship construction.

Every citizen and resident of this great Dominion of Canada, this wonderful country which is capable of such tremendous development, who has the interests of the Dominion at heart, should lend his aid, where possible, towards stimulating and fostering the shipbuilding industry in our midst. A country cannot live to itself, and overseas commerce is as vital to its existence as light and air are to its inhabitants. It is not to be questioned that Canadian products should be carried to the uttermost parts of the world, and surely they should be carried in Canadian vessels if it is possible to do so. The proud position of the British Empire to-day is attributable in no small measure to her wonderful Mercantile Marine, and to the foresightedness of the men who direct it now, and have directed it in years gone by.

No one can find fault with Canada as a nation for endeavouring to carry her own products in her own ships. Our friends across the border have the same end in view, and we have no right to expect them to think or act differently. Competition is good in most lines of business, and is certainly no detriment in the building and operating of steam boats.

Our interest, however, as The Engineering Institute of Canada, is primarily Canadian. It would be very strange if it were not so. It is our duty, therefore, to stimulate our local industries, and in stimulating them, to do our share in helping to make them more efficient, so that the trade mark "Made in Canada"—whether it be on beaver board or ships—may be a sign of excellence and superiority.

So far as the building of ships is concerned, the world now knows that Canada can build ships. We, who are connected with ship design and construction in Canada, ask the co-operation and assistance of our colleagues in the allied professions, to the end that the ground Canada has gained in this business may not be utterly lost. Wages must come down, cost of materials and of living must come down if we are to be on anything like an equal footing with our competitors.

All lines of business, more or less, are suffering from depression, and this is not peculiar to Canada. This depression will pass away, however, and business will inevitably improve. Let us be sure that we are ready and equipped in every way when the day of improvement comes. We, in the ship game, are doing the best we can to keep things moving.

OIL FUEL IN GREAT BRITAIN

The development of the use of oil fuel for many purposes in Great Britain is illustrated by the construction of large storage depots at various points. In one of the latest which is being constructed on the Tyne, there are two tanks of 8,000 tons capacity each and a similar one of 4,000 ton capacity forming the first instalment of a very large depot. The tanks have been erected near the jetty, with which they are connected by means of pipe lines. Vessels desiring to obtain supplies of oil fuel will berth in deep water alongide the jetty. Along with this development in oil storage there is proceeding a very active production of oil engined ships in British yards, and some of the ships have achieved remarkable economic results. One of them on her maiden voyage across the Atlantic consumed only 130 tons of oil. This was 200 tons less than the amount which the engineer had calculated would be necessary.

SUNKEN TREASURE

During the war many vessels containing valuable stores were sunk by submarine or by mines. Among them was a liner which contained amongst her cargo 20 bars of gold, each worth about £1,500. An enterprising effort is being made by British salvage ships to recover this treasure in spite of the fact that the ship was so badly broken up that the gold was buried under many tons of wreckage. This wreckage has to be blasted and carried away to another part of the ocean. So far only seven bars of gold have been picked up, but it is hoped that eventually the skill of the British divers will secure the recovery of the whole amount.

THE WORLD'S LARGEST LINER

A British shipyard is at present completing the "Majestic" which will be the largest vessel in the world. This mammoth is nearly a thousand feet long; it measures 102 feet from keel to bulk, and has a breadth of over 100 feet. She will be capable of carrying 4,000 passengers, and her speed will be 23 knots per hour on the average. Very special care has been taken to secure the highest possible measure of safety. Over a portion of the length of the ship there will be a double skin; and water tight bulk holds have been liberally provided. In order to guard against fire the steel bulkheads are coated with fireproof material and a complete system of automatic fire alarms has been installed. A special smoke detecting apparatus has also been provided, and the entire system is centralised on the navigating bridge where a constant watch is kept. The "Majestic" will burn oil instead of coal and will be driven by steam turbines connected with four propeller shafts. Elaborate cold storage is provided for the preservation of food, and ample provision is made for ventilation and for heating. There will be about 15,000 electric lamps on the ship, and the electric power installation is as large as that usually found in a small town. Four wireless telegraph installations are being arranged.

A Guide to the Canadian Marine Certificate

In This Article the Subject of Involution and Evolution Is Taken Up. This is More Popularly Known as Square and Cube and Their Roots, Various Examples Are Worked Out

By T. H. Fenner

WE HAVE covered the ground fairly well in the two previous lessons as far as fractions and decimals are concerned. By this we mean that we have given sufficient indication of the methods of using these functions to enable the student to perfect himself after a little practice. We propose now to indicate the methods of raising numbers to their different powers, and of extracting the roots of the various powers of numbers. These operations are known as involution and evolution. While it is as well to know how to perform these operations arithmetically, we would like to emphasize here that it is far more easy to use tables, either those giving the powers and roots of numbers, or logarithmetic tables. It is not only easier, but there is less liability to error, while time is saved which would be used in making long calculations. There are cases where the only way to get the result is to use either tabes or logarithms. However, we will indicate the method of getting the square and cube root by the ordinary arithmetical way, and leave it to the reader to find out the use of the tables, or logarithms if he feels like it. We may take up the use of logarithms at a later stage of these articles, but at present we wish to get over the preliminary ground as quickly as possible, and reach the actual engineering problems.

Involution

Involution is the act of multiplying a number by itself a given number of times, the number itself being the root, and the times it is multiplied by itself being the power of the number. The power to which the number is to be raised is indicated by a small number placed above and to the right of it, as for instance 3^2, which signifies that 3 is to be multiplied by itself once, or in other words, to be raised to the second power, or as usually expressed, to be squared. If it is 3^3, it means 3 is to be multiplied by itself twice as $3 \times 3 \times 3$ or to be raised to the third power. The same applies to all the powers, as 3^4, 3^5, 3^6, and so on. The small number is known as the index or exponent of the power.

In multiplying together two powers of the same number as $3^3 \times 3^3$, the exponents or indices are added together, thus $3^2 \times 3^3 = 3^5$. Two powers of the same number are divided by subtracting the exponents thus: $3^4 \div 3^2 = 3^2$. If we have $3^2 \div 3^4$, we get as the result of the subtraction, $2 - 4 = -2$, then the exponent will be 3^{-2} or three to the minus 2 power. Now the minus 2 power can be expressed by making the number the denominator of a fraction with one for its numerator, and raising the denominator to the power indicated. Thus 3^{-2} would be written as $1/3_2$. Take $2^3 \div 2^9 = 2^{-6} = 1/2_6$: The exponent of the power may be a fraction and then means that the number is to be raised to the power shewn in the numerator, and the root as expressed by the denominator extracted. For instance, take $2^{2/3}$ means that the cube root of 2 squared is to be taken, or we might write it as $\sqrt[3]{2^2}$. If written thus, $2^{1/2}$ we know it means to take the square root of 2, because the first power as expressed in the numerator of the index, is the number itself. 2 to the first power is 2. The zero power of a number always equals 1. Thus

$$2^0 = 1,\ 3^0 = 1,$$

$$3^1 = 3,\ 3^{\frac{3}{3}} = 3.$$

There is no limit to which a power can be raised, but in practice it is only the first two or three powers which are in general use.

For the work we are concerned with the square, cube, and fourth powers and roots will be ample.

Evolution

The extraction of the root of a power of a number is known as evolution. In the ordinary way, it involves a lot of work, and is better achieved by the use of tables. However, in order that it may be of use in refreshing the memory of some, and instructing others, we will give herewith the method of extracting suare root and cube root by the arithmetical process. Square root is comparatively simple, but cube root is more involved. The fourth root can be obtained by extracting the square root, and then extracting the square root of the result. In other words, it is the square root of the square root. The sixth root is the square root of the fourth root. The ninth root is the cube root of the cube root. If a number is to be raised to a power, and a different root extracted, the whole thing can sometimes be done by dividing the index of the root into the index of the power. Thus $2^{6/3} = 2^2 = 4$. $2^{9/3} = 2^3 = 8$ and so on. The small figures in this case representing fractions.

The method of extracting square root will now be explained in detail. The first thing to be done is to space off from the unit figure every two figures. If we have a number 784, which we want to extract the square root of we will start at the figure 4 and space off to the left. We will have 7,84.

Now take the first figure 7 and divide it by the greatest number whose square is less than 7. The square of 3 is 9, so that is too much. The square of 2 is 4, so we can take that. This will be the first figure of the quotient and the sum is set down as follows:

```
784(2
4
—
3
```

The next operation is to bring down the two figures remaining, and place them after the 3, making the sum

```
784(2
4
——
384
```

We then multiply the first figure of the quotient by 2, and bring the product down to form the next trial divisor. We now have

```
784(2
4
——
4    384
```

4 is now the first figure of a new divisor for the number 384. We try 4 into 38. It will go 9 times. We place 9 after the 4 and try it, thus $49 \times 9 = 441$. We see it is too much. We then try 8, which makes $48 \times 8 = 384$. We see this is an exact dividend. We therefore place 8 in the quotient and alongside the 4 and we now have:

```
784(28
4
——
48   384
     384
     ———
```

And the square root of 784 is 28. Let us take another number, say 4225. Proceed as at first, spacing off each second figure from right to left. Then we have 42 25.

What is the greatest number whose square is less than 42? We can decide this mentally. It is 6, so we have

```
42.25(6
36
—
.6
```

and bringing down the next two figures

```
4225(6
36
——
.625
```

We then multiply the first figure of the quotient by 2, as before and get 12 as the first part of the trial divisor, which gives us:

```
4225(65
36
——
125  625
     625
     ———
```

65 being the required square root.

In both the preceding cases, the root has come out even, but this is not always so. We may have a fractional result, and it is usual to make this a decimal, as it is very simple to carry out. Let us find the square root of 8. The nearest root figure we can think of is 2, the next 3 being too large, and the square of 2 is 4, thus giving us the following:

```
8(2
4
—
4
```

There are no more figures to be brought down, and we have a remainder of 4. We proceed as follows: Put a decimal point after the 2 in the quotient, and add two ciphers to the remainder in the dividend. Thus we will have:

```
8(2.
4
——
4   400
```

We have then 4 as the first figure of our trial divisor. What will be the second? 4 into 40 will go 10 times, but that is not practicable. Try 9, which would make the divisor 49, and the next figure of the quotient 9. $49 \times 9 = 441$ which we see is too much. Let us try 8 which gives $48 \times 8 = 384$ which will go. We now have:

```
8(2.8
4
--
48  400
384
——
.16
```

We must now bring down two more ciphers, and multiply the quotient by two for a trial divisor, thus:

```
8(2.8
4
—
48  400
384
——
56  .1600
```

The next figure will be 2, by trial, and we can proceed. Each new trial divisor is found by doubling the root all ready determined, and the dividend is continually renewed by adding two ciphers. The root is carried to as many places of decimals as is thought necessary, though of course, it might never work out exactly. Let us see how far it goes:

```
8(2.828427
4
48  400
384
——
562  .1600
1124
——
5648  47600
45184
——
56564  .241600
226256
——
565682  1534400
1131364
————
56568547  .40303600
```

We can dispense with any further decimals and call the square root of 8 — 2.8284. Suppose now, we have to find the square root of a decimal fraction and a whole number, we proceed just the same. The figures before the decimal point are spaced off in twos from right to left, and those after the decimal point from left to right. The root is then extracted in just the same way as before.

Find the square root of 25.25:

```
25.25(5
25
—
..25
```

Here, we have found the complete root of the integral part of the number, and now have the decimal part remaining. Multiply the root already found for the trial divisor, and place a decimal point after the first figure of the root. We then have the sum in the following form:

```
25.25(5.
25
—
10  .25
```

As we cannot divide 10 into 25 and still provide for the second figure of the root, we add a cipher to the quotient and one to the trial divisor, and add two ciphers to the dividend, giving us:

```
25.25(5.0
25
—
100  ..2500
```

We can now divide, 2 being the figure to add to the root, and then proceed as usual:

```
25.25(5.02493
25
—
1002  2500
2004
—
10044  49600
40176
——
100489  .942400
904401
——
1004983  .3799900
```

The square root to 5 places of decimals is 5.02493 which is not an exact result, but is very slightly in error, as a simple proof will show.

```
5.02493
5.02493
———
1507479
4522437
2009972
1004986
2512465
————————
25.2499218049
```

Leaving off all decimals after the fourth the error is 25.25—25.2499 — .0001 or $\frac{1.}{10000}$. The square root of a decimal quantity is found in the same way. The square root of .5 will be found in this way.

As there is only one figure after the decimal point, we add a cipher an it .50. The nearest square root is .7 and we have:

```
50(7
49
—
14  .100
```

We must add a cipher in the quotient and one in the divisor, adding two to the dividend, thus getting:

```
50(7071
49
—
140  10000
1407  9849
———  ——————
14141  15100
14141
——————
959
```

the root is then .7071.

If we had to find the root of .05, we would be able to go straight ahead, as we would then have two figures after the decimal point. The reason there must be two figures after the decimal point is obvious after a little thought. When we multiply decimals, the product will have as many places of decimals as there are in multiplicand and multiplier. Therefore in the case of .5, the square root cannot be .2 as .2 multiplied by itself gives .04. On the other hand, the square root of .05 is .2236. The square root of .005 would again be different. Pointing off, the first two figures would be ciphers. We would, therefore, put a cipher in the quotient after the decimal point and bring down the next two figures. There is only one, 5, so we add a cipher to that, and then take the nearest root. The work is as shown:

```
.005(.0707
00
—
50
49
—
1407  .10000
9849
——————
14  151
```

This should be sufficiently clear to all by now.

In taking the square root of a fraction, the square root of denominator and numerator are taken separately. For instance, the square root of $\frac{25}{36}$ would be $\frac{5}{6}$. When a fraction is to be raised to a power, it is indicated by enclosing it in a bracket and putting the exponent or index at the top right-hand corner, as:

$$\left(\frac{5}{6}\right)^{3} \quad \text{or} \quad \frac{5^{3}}{6^{3}}$$

When the root is to be extracted, it is written $\sqrt{\frac{5}{6}}$ or $\sqrt{\frac{3}{6}}$ as the case may be. Find the fourth root of $\frac{625}{1296}$ would be written $\sqrt[4]{\frac{625}{1296}}$. First find the square root of $\frac{625}{1296} = \frac{25}{36}$. Then take

the square root of the latter $\sqrt{\frac{25}{36}} = \frac{5}{6}$.

We could give examples indefinitely, but feel that the foregoing should serve all practical purposes.

Cube Root

We dealt in our last article with the square root, and now will proceed with the more complicated and tedious process of finding the cube root. We would again take the opportunity of recommending readers to familiarize themselves with the use of tables for this work. It is a good thing to know how to extract cube root in the ordinary way, but no busy man has got the time to go through its labored processes. The use of tables also reduces the risk of error, especially in quantities involving the roots of decimal numbers.

In extracting the cube root, the number is divided into periods of three figures each, instead of two, as in square root, beginning at the unit figure, and going to the left. The figures would be pointed off thus:—

1,231,456

The first step is to find a number whose cube is smaller than the first period, and this number will go in the quotient as the first figure of the root to be found. The cube of this figure is then subtracted from the first, or left-hand period, of the number, and the remainder, and this forms the next dividend.

The procedure so far would be as follows. Suppose we have to find the cube root of 15625. Point off into periods:

15,625

Then find a number whose cube is less than 15. The cube of 3 is $3\times3\times3=27$, which is too high. The cube of 2 is $2\times2\times2=8$, which will do, as it is less than 15. Then we have

```
151625(2
8
-----
7625
```

The next thing is to find a divisor for 7625. To obtain this the first figure of the quotient is squared, and then multiplied by 300. This is the trial divisor. The quotient is put down after the first figure of the root. To complete the divisor, the two figures in the root are multiplied together, and the product multiplied by 30 and added to the trial divisor. The second figure of the root is squared, and also added to the trial divisor.

The sum of these operations must be multiplied by the second figure of the quotient, and the product subtracted from the remainder. If the product is greater than the remainder, the second figure of the quotient must be reduced by one, and the trial divisor altered accordingly. Let us apply these rules to the example we have:

```
151525(26
8
-
7625
2×2×300=1200
2×6×30 = 360
6×6  =  36
-----
1596
```

Here we have taken 6 as the second figure of the root, and used it in the operation of finding a trial divisor. The sum of the various factors of the divisor is 1596, and a glance shows that when this is multiplied by 6 the product will be greater than the remainder. We must therefore reduce the second figure of the root by 1, and try again:

```
                15625(25
                8
               -------
2×2×300=1200    7625
2×5×30 = 300
5×5  =  25
-------
1525            7625
```

This divides out exactly, and the cube root is 25.

The rule as worked out above can be stated briefly as follows:

Divide the number whose root is to be found into periods of three figures each starting from the unit figure. Find a number whose cube is less than the first period and this figure will be the first figure of the quotient, or root. Subtract its cube from the first period, and bring down the second period, which, with the remainder, forms the next dividend. To find the second divisor square the first figure of the quotient, and multiply it by 300. The product forms the initial trial divisor. The quotient of this trial divisor must be set down after the first figure of the quotient, forming the second figure of the root. To the initial trial divisor add 30 times the product of the first an dsecond figures of the quotient, and to these add the square of the second figure of the quotient. The sum will be the final trial divisor, and is multiplied by the second figure of the quotient, and the product subtracted from the remainder. If the product is too large to subtract from the remainder, reduce the second figure of the root or quotient by 1, and correct the factors of the trial divisor accordingly.

It will be readily appreciated that unless one is using these rules very frequently, they cannot be retained by the ordinary memory. It can also be seen that there are lots of opportunities for error, in the various calculations to be made. It is a notable fact that it is very rarely one finds a designer or mathematician who can find cube root by the ordinary rules. They invariably use tables or logarithms.

We will give a few more examples of cube root, to familiarize the reader with the process, and will then leave it with no regrets.

To find the cube root of 764,839,412, we divide off into periods, and find the first figure of the quotient, which will be 9:

```
                764,839,412(914.4
                729
               ----------
9×9×300=24300   35839
9×1×30 =  270
1×1 =       1
            -----
            24571   24571
            ------------
91×91×300=2484300   11268412
91×4 ×30 =10920
4×4  =      16
            -------
            2495236     9980944
            ------------------
914×914×300=250618800   1287468000
914×4  ×30 =  109680
4×4    =         16
              ---------
              250728496   1002913984
              ----------------------
                          284554316
```

We could safely say that the cube root is 914.5. If this is multiplied out, it will be found its cube is not quite in agreement with the number, but the discrepancy can be reduced by taking further places of decimals.

To find the cube root of a decimal number, proceed the same way. Suppose we want the cube root of .5. In order to have the necessary three figures add two ciphers to the .5, making it .500. Then the first figure of the root will be .7. Thus:

```
                .500(.7937
                343
               -------
7×7×300=14700   157000
9×7×30 = 1890
9×9  =  81
-------
16671   150039
--------
79×79×300=1842300   6961000
79×3 ×30 =  7110
3 × 3 =       9
-----------
1849419   5548257
----------
793×793×300=188654700   1412743000
```

The cube root of .5 is therefore .7937. Let us multiply this out to see how near it comes:

```
.7937
.7937
-----
55559
71433
55559
-------
62995969
.7937
-------
440971783
188987907
566963721
440971783
---------
.499999005953
```

We see it is practically correct.

If we want the cube root of .005 we find the nearest cube to 5 first, as we have three figures after the decimal point. The work would be then as below:

```
                .005(1709
                1
               -------
1×1×300=  300   4000
7×1×30 =  210
7×7  =  49
-------
559
```

	—	4000
	559	3913
17 × 17 × 300 =	86700	87000000
170×170×300=	8670000	
170×9 ×30 =	45900	
9×9 ×300=	24300	35839
	8715981	78743829
		.8256171

The cube root is .1709. Proving this by multiplying out we get:

.1709
.1709
15381
11963
1709
.02920681
.1709
26286129
20444767
2920681
.004991443829

which is almost exact.

It will be noted that there is a cipher in the root at the third figure. This occurs on account of the trial divisor, 86700 being too large to divide into the remainder. When this happens in any problem, add a cipher to the root and bring down three more figures in the remainder, and proceed as before.

The cube root of a fraction is found by taking the cube root of the numerative and denominator separately. Thus would be written thus:

the cube root of $\frac{125}{512}$ would be $\frac{5}{8}$ and would be thus:

$$\frac{125}{512} \quad \frac{5}{8}$$

If the fourth root of a number is required, the square root of the square root is taken. If the 6th root is required the fourth root of the square root is taken. for any higher roots or powers it is advisable to use tables.

The writer thinks that the preliminary ground has been covered fairly well, but if there is any point not clear to a reader, he will be glad to explain it in more detail. We will now be able to take up in the next articles definite problems relating to the requirements of the various certificates.

We have received from the Abacas Engineering Supply Co. of Birkenhead, England, a circular describing their milling machines. These are made in plain, horziontal and universal vertical styles. Various attachments are illustrated on the circular and examples of milling work on the plain horizontal machines are also shown.

MOTOR VESSEL "BRITISH INDUSTRY

According to present plans a specially designed Exhibition Ship, under the title of "BRITISH INDUSTRY," will set sail from the Thames in the summer of 1923, for the chief ports of the world. She will proceed to the west coast of South America, where there will be four ports of call, viz., Bahia, Rio de Janeiro, Monte Video, Buenos Ayres.

She will then sail due east to South Africa, calling at Cape Town and Durban, and thence to Australia, where the ports of call will be: Fremantle, Adelaide, Hobart, Sydney and Brisbane. After proceeding to New Zealand and calling at Wellington, Lyttleton and Auckland, the ship will steer north by way of Fiji to Yokohama, Kobe, Shanghai and Hongkong.

Seven days are allowed for docking and repairs at Hongkong, and on the 358th day after leaving London the ship is timed to start on her homeward voyage via Manila, Saigon, Singapore, Batavia, Penang and Rangoon.

In India the ports to be visited are Calcutta, Madras, Colombo, Bombay and Karachi, and on the way home the vessel will make a short stay at Aden, Malta and Gibraltar.

An examination of the itinerary shows that during a voyage of 18 months' duration, a distance of 43,000 miles will have been covered and 34 important trade centres visited. The table allows for a stay of from a week to a fortnight at each place showing a total of 346 days during which the Exhibition will be open.

In mapping out the voyage care has been taken to reduce sea-passages to a minimum. Trade centres will, therefore, be visited according to their geographical relationship, and the cruise has been so arranged that the voyage to India and the Far East will not coincide with the period of the South West Monsoon.

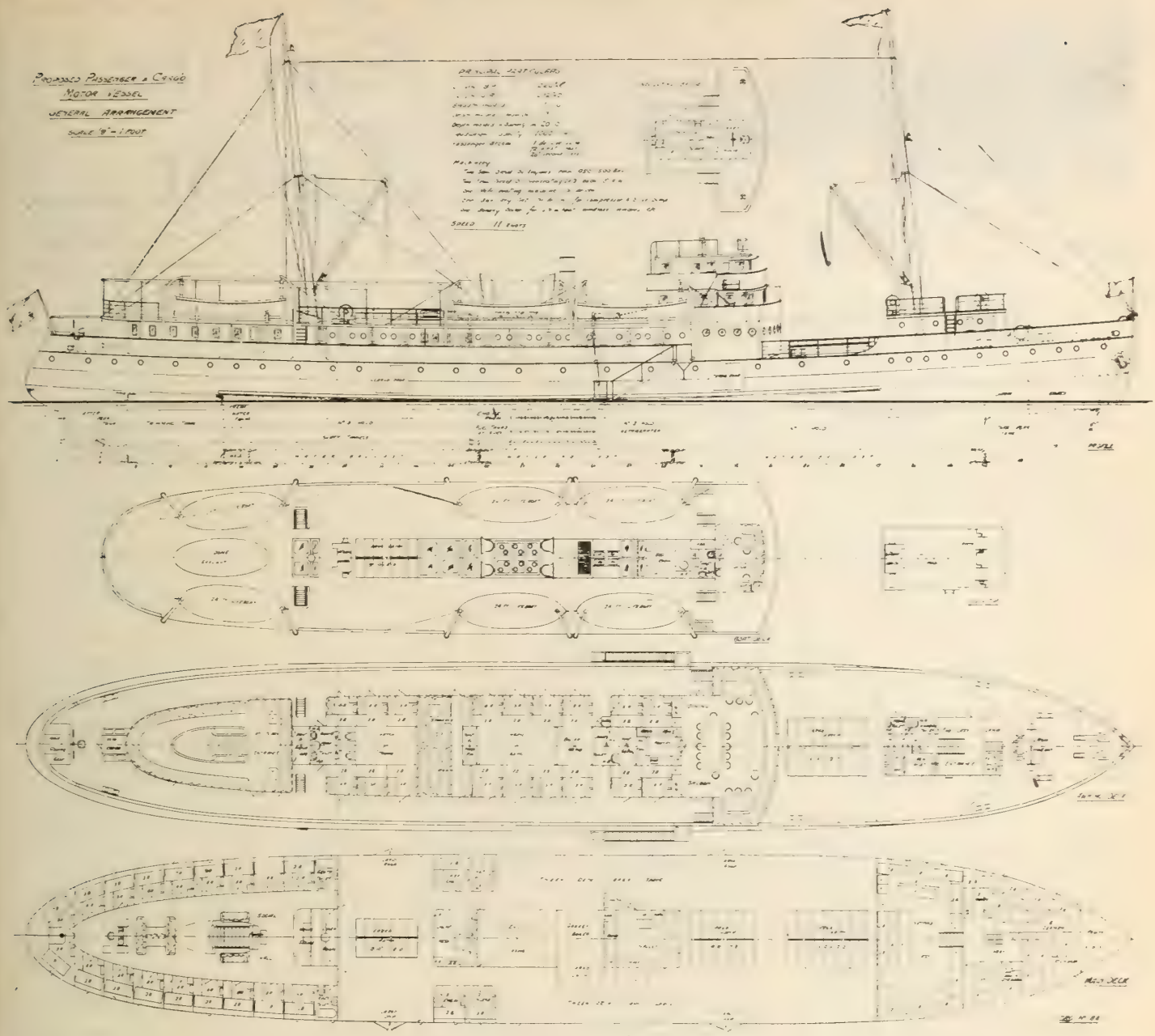
This British Trade Ship will be specially constructed for the purpose of an Exhibition, and every detail of her equipment from the engines to the fittings and furniture, will itself be an exhibit of British workmanship at its best. She will be as large as a first-class liner, having a gross tonnage of 20,000 tons and in her internal arrangements will differ from any ship that has ever been floated. There will be eight decks, four of which will be devoted to the Exhibition proper. On the other decks besides the numerous cabins set apart for the Trade Representatives who will undertake the journey, accommodation will be provided such as few buildings on shore can show. Round a large reception hall are grouped the principal exhibition offices, an enquiry bureau, a bank, an insurance office, interpreters' offices, telephone exchange, writing rooms and cloak rooms. Opening out of the grand entrance hall is a restaurant capable of seating and dining 500 persons. A reception and ball room with domed roof extends nearly the whole length of the boat deck. A cinema which can be used for exhibition purposes and for showing processes of manufacture, is installed at one end. At the after end is a verandah cafe. On the shelter, bridge and promenade decks are committee and private reception rooms, a spacious library, writing room and smoking room.

For many years the idea of chartering and equipping a vessel as a Floating Exhibition of British manufacture to proceed overseas has been mooted and urged but it has now come to be recognized that the mere conversion of an existing vessel is inadequate. The promoters of the present scheme realized that the first necessity was to construct a ship specially for this purpose. They therefore approached Messrs. Swan Hunter & Wigham Richardson, Ltd., who readily entered into their views, and produced the design under notice. A company called the British Trade Ship, Ltd., has been formed, with registered offices at 12 Grosvenor Gardens, S.W. 1, and a strong board asembled under the Chairmanship of Earl Grey. Among the Directors are the Vice-Chairman, Sir G. B. Hunter (Chairman of Messrs. Swan Hunter, etc.) the Duke of Northumberland, Commr. R. W. Day, Major G. P. Denton, Sir Maxwell Hicks, Messrs. J. W. Beaumont Pease, Noel E. Peck, T. E. Thirlaway and Edmund Hill (General Secretary of the Federation of British Industries). The venture is likely to be of the greatest possible benefit to the export trade of the British Empire and is bound to make a strong appeal to our merchants and manufacturers.

It is of importance to note that arrangements will be made for forwarding fresh samples to meet the ship at any particular spot, so keeping the Exhibition both up-to-date and appropriate to the countries visited. Thus it will be possible to change the exhibits at the last port call in each continent. For instance, at Buenos Ayres the exhibits for South America may be landed and replaced by others more suited to the Cape, and so on and so forth.

Other times, other methods. The scheme of the Trade Ship is a great advance on the old-time bagman proceeding from town to town, and packing and repacking his meagre samples at each halting place. A comparison between the two methods will reveal an enormous saving of time and cost. The arrival at each trade centre of the great white ship "British Industry" will be an event long looked forward to. At each port Reception Committees will have been formed in advance, whose duties will be to make known the advent of the seaborne Exhibition, to prepare lists of important firms and individuals, the description of the business in which they are interested, and all other information which may be useful.

Fuller details concerning the Floating Exhibition are, we understand, to be available at the Shipbuilding, Engineering and Machinery Exhibition at Olympia, which opens on September 7th.



PASSENGER AND CARGO MOTOR VESSEL FOR ST. LAWRENCE TRADE

There has recently been evidence of a revival in shipping business in the Gulf of St. Lawrence, which was more or less quiescent during the War period. Several shipping companies have been formed during the past few months and vessels required for this service, and with further development of pulpwood and other companies, there is little doubt but that Coastwise shipping along the shores of the Gulf of St. Lawrence will continue to expand.

The study of the plans of proposed vessel for this route is, therefore, of interest, and these plans are reproduced herewith.

The vessel illustrated has a cargo capacity of about one thousand tons deadweight, and accommodation for seventy-two first-class and twenty second-class in addition to a special "de luxe" suite for Owners or distinguished guests.

This vessel will be propelled by means of semi-Diesel engines, consuming crude oil, which will result in great economies being effected in fuel, space, weight and personnel.

So far as fuel is concerned, it is estimated that this vessel will run on a consumption of about 1,500 gals. of oil per day, costing $120. As the H. P. is one thousand, and the speed 11 knots, it is evident that this compares very favorably with a steam installation both as regards weight and cost of fuel. The weight of machinery is also very favorable, being forty-five tons against one hundred and fifty tons, which would be necessary in the case of a steam engine installation, while the space occupied is only about one-half. No stokers are required, while the absence of cinders and smoke is particularly attractive in a passenger vessel.

The hull is built of ice-breaker form, having cruiser stern. Cargo can be shipped either by derricks through hatches or tructed through side doors and lowered into holds by a system of shafting and belts driven by an engine, while one of the holds being installed and cooled by a refrierating plant, can be utilized fr the carriage of perishable cargo.

The machinery installed is comprised as follows:—

Twin semi-Diesel crude oil engines of 500 H. P. each.

Two semi-Diesel electric light generating sets, each of five k. w. capacity.

One refrigerating machine.

Two semi-Diesel auxiliary sets for compressors, bilge pumps, sanitary pumps, etc.

One donkey boiler for steam heat, steering gear, windlass, winches, etc.

One steam emergency compressor.

IN AN effort to send silk shipments to the Eastern markets in minimum time the Admiral Line steamships (Pacific Steamship Company) will discharge silk cargo in Victoria instead of at Seattle, and consignments will be rushed across the continent by Canadian railroads to Newark and other centres. The first experimental shipment was landed in Victoria from the "Silver State", one of the Admiral Line Oriental steamers. If this innovation proves successful, regular shipments will be made via Victoria in order to eliminate the time taken in shipping through Puget Sound.

* * *

The Yamashita Kisen Kaisha, of Kobe, has perfected plans for a new triangular service between Japan, Australia and North America, according to advices just received. Only freight will be carried. Portable ports of call are Sydney, Melbourne, Adelaide, Auckland, Honolulu, San Francisco, Portland, Seattle, Victoria and Vancouver.

* * *

Duplication of the Pacific cable, linking Australasia with Canada, is proposed by the Pacific Cable Board, according to Sir Timothy Coghlan, a recent visitor here. Sir Timothy who is agent-general for New South Wales in London, says that two cables would insure against interruption of service due to accidents.

It has been officially announced that Canadian Pacific Steamships Ltd., will be the new name, effective September 8, for the company known as the Canadian Pacific Ocean Services, Ltd. G. M. Bosworth continues as chairman of the board of directors and the organization remains unchanged except for the name. This move is taken as a further step in the desire to maintain the closest relations between the railway system and the steamships.

* * *

The Sir John Jackson Company, famous British engineering and contracting company, has decided to abandon Canada as a field of operations and will not bid on future projects in this country, according to Alfred G. Wilson, who is now in Victoria supervising the closing of the plant here. The sailing ship Mafalda has been purchased to carry away the extensive gear and machinery, locomotives and fixtures required by the company in building the Victoria break water, a job which was completed in 1914 at a cost of about $4,000,000.

Mr. Wilson states that his company objects to the method of letting contracts in Canada and that his company's policy is opposed to sub-letting. Recently the Sir John Jackson Company bid on the Ballantyne pier in Vancouver, the drydock at Esquimalt and some works in Edmonton, and lost in each case.

* * *

A powerful radio plant with a radius that will give direct wireless communication with the Far East and also Washington, D. C., will be established at Dutch Harbor, Alaska, according to L. L. Jackson, in charge of a party of engineers which arrived here recently after overhauling American radio plants in the Pribiloff and Aleutian Islands. A wireless station already exists at Dutch harbor, but the new plant will have a 300 kilowatt apparatus. While in the north Mr. Jackson and his party put into commission two radio-telephones stations on Unimak Island for intercommunication between the wireless stations of the Alaska coast. The larger plants include St. George and St. Paul in the Pribiloffs, Dutch Harbor, Scotch Cap, Seward, Cordova and Ketchikan. Altogether, the United States government is operating thirteen plants in the north.

* * *

Word has reached here that the old German steamship Sesostris, which was salvaged by Victoria shipping interests from the sand dunes of Guatemala during the war, has again changed ownership. She was sold at an auction in Cherbourg, France, to a Spanish concern known as La Estrella del Sur Compania Anonima de Navigation for about $130,000. Since the Pacific Salvage Company brought her north and sold the Sesostris to the Skinner & Eddy interests, Seattle, she has changed hands three times.

* * *

Refrigerator space will shortly be installed on three Canadian Government steamships in order that they may engage in the frozen meat trade between Australia and this country; the Canadian Highlander, Canadian Scottish and The Canadian Winner. The Canadian Skirmisher has already been outfitted with cooler space, and the Canadian Importer was also scheduled for this accommodation prior to her accident. The Goverment vessels have already this season carried 38,000,000 feet of lumber, which is almost half of last year's shipments. The Highlander will be outfitted by the Kidston Company, Montreal.

* * *

The Canadian Importer, of the Canadian Goverment Mercantile Marine, missing for several days off the Oregon coast, has been picked up in a disabled condition and is now at Yarrows, Ltd., Esquimalt, undergoing repairs. The Canadian Goverment patrol ship Givenchy ran aground near Bella Bella September 6 and her rescue will present a difficult salvage task.

* * *

An active effort to increase existing business between British Columbia and Central and South America ports has been started with the appointment of B. J. Johnson-Walton Company, Vancouver, as agents in this territory for the Latin-America Line. This office has opened a monthly connection with the southern continent. This development is really nothing more than the resumtion of the operations of the A. Lindvig Line, suspended during the war. Hakon H. Hammer, president and general manager of the Universal Shipping and Trading Company, of Seattle, recently announced the new service to embrace British Columbia points. The steamers Baja California and Sinaloa, will operate to Central America, and the steamships Romulus, Remus and Regulus will travel between B. C., Puget Sound and the more southerly points. The Baja California will load in September for the southbound passage.

* * *

The steamship Princess Louise, launched at the yards of the Wallace Shipbuilding Company, North Vancouver, August 29, is regarded as one of the finest vessels ever turned out by a British Columbia shipyard. She is of steel, 4,200 tons gross, 330 feet over all, 48 foot beam. Her speed will be about 18 knots. The Princess Louise has been built to the order of the Canadian Pacific coast services and will be used in the Northern British Columbia run. If the company is satisfied with the ship's performance, it will not place any more orders in Great Britain and will rely on British Columbia yards in future, according to Captain J. W. Troup, manager of the service, whose head office is in Victoria.

Within the last month five steamships operated by the Canadian Government Mercantile Marine have been casualties. There has been considerable comment in the national capital as a result, and the management has issued a statement pointing out that all the vessels were insured on a war cost basis. The two most recent losses were the Canadian Exporter and Canadian Importer, which were disabled off the Northwest coast, the former breaking in two on the Willapa Harbor Shoals. The hull of the Canadian Exporter has been purchased by H. R. MacMillan, of the MacMillan Exporting Company, and Percy Sills, of the Premier Lumber Company, both of Vancouver. The price paid for the two scattered portions of the hull is said to have been the nominal sum of $2,000. In view of the season and the exposed position, the transaction is regarded as a long-shot gamble, but salvage operations have excited the interest of shipping men all along the coast.

* * *

The Canadian National Railways are planning to equip the outer docks at Victoria with improved cranes and other machinery especially adapted to the handling of lumber cargoes. The chamber of commerce here is leading a movement to strengthen the claims of Victoria as a foreign trade centre, and improvement of the loading facilities at the docks is held to be one of the most important objectives to be undertaken. Chairman D. B. Hanna, of the C. N. R., announced some time ago that this work would be carried out and while there have been delays, C. C. Kernahan, contracting freight agent for the company, was here recently and made it clear that an effort would be made to build up business for the Canadian Government Mercantile Marine steamships, which are being operated in conjunction with the Canadian National Railways. Mr. Kernahan says the company wants to build up the lumber trade with South Africa via Panama Canal and that heavy tonnage will shortly be placed in commission on the trans-Pacific routes.

* * *

The new C. P. O. S. liner Empress of China, formerly the German ship Tirpitz, will be out here to commence regular sailings between British Columbia ports and the Orient in January or February, according to latest reports from England. The Empress of China has a tonnage of 21,000 and is practically new. She is 599 feet in length being 19 feet longer than the Empress of Asia and Empress of Russia, the largest liners now being operated in the Pacific by the company. She is said to be the only ship afloat with turbine transformers of the new German type. She is now in Hamburg, Germany, being given oil-burning equipment.

* * *

Negotiations between the Pacific Steamship Company and the Canadian Pacific Ocean Services, Ltd., for the purchase of the steamship Empress of Japan have been called off. It is understood that the United States Government refused to grant a coasting license for the vessel in case the deal was completed. An option was taken on the Empress of Japan by Vice-president A. F. Haines, of the Pacific Steamship Company, but the deal was held up by regulations prohibiting purchase by American companies of foreign tonnage.

* * *

Successful against the competition of several American firms, Yarrows, Ltd., the Esquimalt ship repair company, has been awarded the contract for patching up the Standard Oil Company's tanker Caddo.

* * *

Firemen's unions have lifted the boycott declared some time ago against the ships of the Canadian Government Mercantile Marine as a result of wage reductions. The sailors are now considering the question and will reach a decision in the near future.

* * *

The British Columbia-California service of the Canadian Government Mercantile Marine is now fully established and regular sailings are being made. The company has secured the contract for handling the output of the northern British Columbia pulp and paper mills and heavy shipments are being made. The Canadian Farmer, Canadian Rover and Canadian Observer are being operated in this route.

* * *

The first direction finding wireless station to be established near here is now in operation at Tatoosh light station close to the entrance of the Straits of Juan de Fuca. The United States government has invited all shipping to make use of these facilities.

* * *

That Prince Rupert will continue as a steel shipbuilding centre, is the belief of H. J. F. Turney, superintendent of the Wallace Shipyards, operating a forty acre plant in the northern port. The first ship built to the order of the Canadian Government, the Canadian Scottish, recently ran her trials and the Canadian English will be launched in September. The Wallace people also operate at North Vancouver.

News from Port of Sorel

LACHANCE Co., Ltd. of Sorel and Quebec, have the contract for the raising of the Canadian Recruit which is sunk at about 50 miles below Quebec. This will be done by means of caissons, 16 x30 feet with a capacity of 170 tons. The system applied will be compressed air. These caissons will be put to water this week (Sept. 22nd) and towed down to where the Canadian Recruit is laying. These caissons will be anchored to the sides of the vessel with chains and will help to raise her. Also, The Transportation and Shipping Co., working in conjunction with the Lachance Ltd., are building two wooden caissons 30 x 25 feet by about 20 feet. These will be put over the hatches and serve for pumping the water out of the hold which is under water at low tide. These caissons will not be closed at the ends. When ready they will be towed down the river by the Gedeon L., a sister ship to the Napoleon L. In this connection, the Gedeon L. was finished in time for this job which will be her maiden trip.

The Lachance Ltd. have a crew of 150 men working on the job below Quebec, also 10 boats.

The Lady Grey and the Montcalm, both Government ships, are at Sorel to undergo general repairs in view of their service for the winter. They will be tested severely before they are allowed to go into service.

Coal Barge No. 5, of the Government Fleet, which had been loaned to the Naval Service Department during the war, and had been stationed near Halifax, has been sent back to Sorel, where she has been hauled at the Government shipyard. The Naval Service Department will put this barge back in the same condition she was in when loaned; this will require considerable work, to accomplish this purpose.

Schooner "Langevin" which took fire near Sorel and had to be sunk near the Government wharf, is being raised by the Transportation and Shipping Company. She has a very valuable cargo.

The regatta which took place at Sorel on the 5th of September was very interesting. Unfortunately, the Emma 11, a fast yacht, had trouble on account of short circuit through water falling on the machines. She had gone 21 of the 25 miles of the race when this trouble happened and the other two boats finished the race; the Killarney coming in first and the port second. The Emma 11 had to be towed back.

Canada Steamship Lines boats, such as the "Cape Trinity," "Cape Eternity" and the "Three Rivers" will winter at Three Rivers, Que., where they have already been sent. During the coming week, the "Rapids Prince" and the "Quebec" will also be sent there for the winter. These boats will be spotted near the Tidewater Shipbuilders' shipyard. As a rule, these boats have wintered at Sorel for years.

At the time of the liquidation of the Leclaire Shipbuilding Co., material for three boilers, 13 ft. 6 in. by 11 ft. 6 in. has been received. Since that time, the Transportation and Shipping Company have taken over the works and completed some of the constructions. Now it is decided that these three boilers will be finished and will carry 180 lbs. pressure. They may possibly be used in the com-

(Continued on Page 25)

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A Selfish Strike

THE strike of ships' joiners, in Great Britain, which has just been concluded after a period extending over nearly nine months, is an example of wrong headed selfishness on the part of one class of tradesmen, which it would be hard to beat. The ships' joiners were asked to accept a reduction in wages from the high standard of war time, in order to allow the shipbuilders and ship repairers a fair chance of competing for contracts, and thus keeping the great majority of workers in the shipbuilding and ship repairing trades in employment. They refused, against the advice of their own leaders, and went on strike. As far as they personally were concerned, there was not much loss, as the house building trades were then experiencing a great amount of activity, and the joiners were readily absorbed in these activities. Not so the other shipbuilding and repairing tradesmen, and as a result of the joiners' action, contract after contract was lost. Ship after ship was sent to Rotterdam, Antwerp, and even to German ports, by owners who wanted to get their repairs speedily and reasonably performed, so that their ships could be put into active service again. New ships which required only the joiner work to fit them for active service, were hung up in builders' yards, where every day they lay represented a loss of thousands, and in several notable cases, these new ships had to be sent abroad for their finishing touches. The close of the strike came after the announcement of Yarrow's Ltd. that they were going to close their yard down until such time as they could be able to quote prices that would give them a fair chance of getting contracts. Whether this announcement had any influence in bringing the men to their senses or not it is hard to say, but there is a reasonable inference that it did. During the whole time that the men have thus been holding up the shipbuilding and repairing trade, thousands of men have been walking about in idleness, drawing unemployment doles from the Government, and adding to the intolerable burden of taxation that the country has to meet. The amount of money that has been lost, and the intolerable hardships imposed on willing workers during the past two years by the action of extremists in the labor ranks, can hardly be calculated. Killing the goose that lays the golden eggs has not worried them at all, but there are signs that at least the sound common sense of the average tradesman is beginning to overcome the effect of the fulminations of so called labor leaders whose chief object seems to be to drive British trade into the hands of foreign competitors, and British workingmen into something closely approaching starvation.

The "Princess Louise"

THE launching of the "Princess Louise," built for the Canadian Pacific Railway Co. coast services, by the Wallace Shipbuilding and Engineering Co., North Vancouver, is an achievement of great credit to the firm that built her, and to British Columbia shipbuilding in general. The vessel was built entirely in British Columbia, engines, boilers, hull, and fittings, interior and exterior, and to the highest classification of the British Corporation. She is a very fine type of passenger liner, and we believe the first of her kind to be built in Canada. It is a fact that the order was obtained in competition with British firms, and conditions prevailing in the shipbuilding trade over there allowed the order to come to British Columbia. There is a vast difference between the construction of a cargo ship, even of the highest class, such as has been built in considerable numbers in British Columbia in recent years, and a first class passenger liner, and there have not been lacking those who thought it could not be done. The vessel is 338 feet long, 48 feet beam and 18 feet 66 inches moulded depth.

She has four Scotch boilers, and triple expansion engines of 4500 I.H.P., the boilers being fitted for oil fuel. Her speed is 16 1-2 knots. There are 131 staterooms, 6 suites de luxe, with all the appurtenances of smoke rooms, lounges, etc.

The vessel represents the type of high class cross channel steamer which has been a notable feature of the British yards, and the construction of such a vessel is distinctly a feather in the caps of her Canadian builders. Let us hope that there will be more to follow.

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News of the Shipping World

THE old "City of New York" after a career of varied fortunes, has been sold to the Polish-American Line for service between the Baltic and New York as an emigrant ship. As Shakespeare has said "To what base may we not descend." This vessel, when she was built in 1888, was the pride of her builders, and one of the Maritime wonders of the world. We remember her well as she appeared in the River Mersey, and she was, with her sister ship the "City of Paris," one of the prettiest steamers we have ever seen, surpassed only by the "City of Rome" built for the Anchor Line. The "City of New York" speedily took the blue ribbon of the Atlantic from the "Teutonic" of the White Star Line, and held it until the Cunard Company built the "Campania" and "Lucania," both now out of existence. The two City's were built for the Inman line, which in those days sailed from Liverpool, but later went to Southampton, and finally they were sold to the American line, and transferred to the American flag. The name was changed to New York instead of City of New York, and they ran for a while with gradually declining patronage. When the Spanish American war broke out, the New York served as an armored cruiser, and later still was used as a transport in the great war. Now after 33 years of active service she has been sold to the lowly duties of an emigrant ship. The fact speaks volumes for the construction of the ship.

THE extent to which pilferage of cargoes has been specialized, is exemplified by an incident which occurred cently to the Ward Line, sailing from New York to Cuban ports. In order to try and prevent this pillage, officers were stationed at all gangways and hatches of the steamers when unloading, with instructions to search any longshoreman who appeared to be making away with a portion of the cargo for his own use. The result of this action was that before it had been in force for twenty-fours hours, a representative of the longshoremen's union notified the steamship owners that if the practice was not stopped within twenty four hours, a strike would be called. This is pretty high-handed action, and shows that the longshoremen in question evidently look on robbery as one of their natural perquisites.

ADVICES from Berlin show that the Germans are getting ready to make a bid for some of the trade on the Atlantic. The Hamburg American line which has been conducting a service with American steamers only in conjunction with the Harriman line, are this month putting their first steamer on under the German flag, the "Bayern." The "Bayern" will be followed very shortly with two more Hamburg American liners, and the service will then be half German and half American, as agreed upon. The same thing is occurring in the freight trade, the joint service of these two companies being half under the German and half under the American flag. The correspondent of the Exchange states that the port of Hamburg is rapidly recovering its pre-war trade, the arrivals and departures in the month of May being about 60 per cent. of those in the same months of 1913. It is rather significant to note that the proportion of the vessels of different nationalities is much different. Before the war the British had a large share of this trade, while now their vessels represent only a fifth of the total, Germany has fallen from 53 per cent. to 17 per cent, while the American share has increased enormously, in fact about 350 per cent.

THE joiners strike in British shipyards has at last been ended, after lasting a period of nearly nine months, by the men accepting a reduction of six shillings a week immediately, and a further reduction of three shillings a week in October, and possibly a further reduction in December. The losses caused by this strike have been enormous, and the peculiar part is that practically every trade connected with shipbuilding has suffered except the men who themselves were on strike. This curious fact arose from the condition of the building trade, which was experiencing a period of great activity, and thus absorbed the men from the shipyards. In the shipyards, however, the joiners' strike worked havoc, and hundreds of repair jobs had to be sent out to the country for the benefit of German and Dutch contractors, while our own men were idle. Ships that had been built in British yards had to be sent to foreign yards to be completed, while thousands of men walked about idle and drew unemployment pay from the long suffering taxpayers. All because one body of workmen, against the advice of their own leaders, and with a cynical disregard of their fellow workmen and the country at large, stuck to an unreasonable and impossible demand. They have a lot to answer for.

THE steamer "Majestic" building for the White Star Line, and claimed to be the largest ship in the world, is expected to be ready for service on the New York run by next spring. The length over all of the "Majestic" is 956 feet, with a beam of 100 feet, and when loaded will have a displacement of 60,000 tons. This enormous bulk has been designed with a view to attaining a speed of twenty three knots. She is fitted with anti-rolling tanks as well as bilge keels, but the latest development of anti-rolling devices, the gyroscope, has not been fitted. The protection against fire is very elaborate, whole sections of the ship being arranged so as to enable them to be isolated at any time. Further particulars of this giant vessel will be given when available.

THE welfare of the crews of Australian coastwise steamers has always been well looked after, and they have been keen on retaining their privileges. In order to still further bring things their own way, recent legislation in the Australian house prevents overseas steamers from carrying passengers coastwise unless they alter their crew to conform with the coastwise regulations, which, naturally, it would be almost impossible to do. Now this may seem purely a matter that interests the steamship owners only. However, much inconvenience is caused to passengers through this piece of paternal legislation. The Australian correspondent of "Syren and Shipping" sends the following account of the workings of the act to his papers: "Passengers in the P. and O. liner Mantua who had booked to Fremantle, Adelaide, and Melbourne, and were for business and other reasons desirous of continuing the voyage to another port, were informed at Fremantle that they would be unable to do so in consequence of the Act. This, he says, caused consternation and surprise among the passengers, as there were a number who, since leaving Plymouth, had found it necessary to disembark at ports farther along the Australian coast than the ports for which they had booked. Among this number was the newly-appointed aide-de-camp to the Governor-General, who was booked to Melbourne, but received instructions to go on to Sydney. He was informed, however, that he could not re-book for Sydney, as the Navigation Act would not permit of this being done, and that he would have to make the journey by rail. Another passenger, an immigrant with limited means, was placed in the same position, but in his case the results were far more serious, as apart from heavy railway fares, he would probably have hotel expenses to meet. One of the saloon passengers, who had booked by the Mantua for Melbourne, informed the officers of the steamer that he would not disembark there, but would go on to Sydney, as he had received a telegram from a man with whom he intended doing business. He was astounded when informed that the request could not be acceded to, and that he would have to travel by rail. Unless the Navigation Act is amended to allow of overseas passengers continuing their voyage in Australia beyond the ports for which they originally booked, or the position of the overseas shipping companies in regard to the interpretation of the Act in this regard is made clear, much trouble," adds our correspondent, "is likely to occur."

The Advantages of Water Tube Boilers

By Sir James Kemnal

IT IS not intended that the order in which the advantages as compared with the world-tried cylindrical boiler are mentioned shall indicate that stress is put upon one advantage more than another. They are all advantages that are worthy of consideration by shipowners and marine engineers, and one may be considered of more value than another dependent upon the service that is under consideration.

The safety of the type as compared with the cylindrical boiler can scarcely be questioned, for no accident can conceivably happen to this type which could cause the loss of a vessel, or, indeed, any serious damage to it. There are no thick plates subject to racking strains, and the various parts are small, and in relation to the working pressure have a large margin of safety.

It may be urged that the failure of some part, putting the boiler out of service, might cause damage to a vessel if the ship were only fitted with a single boiler, but the worst that can happen is that one or more tubes can give out and these can be easily replaced at sea by new ones or plugged with very little loss of time. It is found in practice that such an occurrence is very rare, and it has not been known that any instances have occurred in which a vessel in recent times has been disabled from any cause connected with the design or construction of the boilers—although there have been instances in which through improper treatment, damage has occurred from a cause which would have been equally, if not more, damaging to cylindrical boilers.

This boiler can be maintained by the ship's engineers in repair if desired, and the repairs in almost all cases are confined to replacement of tubes.

It can be constructed for much higher pressures than are customary with cylindrical boilers, and, therefore, whatever advantage there may be in adopting pressures above those that are customary, such can be made use of without difficulty.

Perhaps the advantage which most appeals to the shipowner is the saving in weight which may range between about 100 tons in a vessel of 2,000 horse-power to about 700 tons or more in a vessel of 18,000 horse-power. These figures are based upon boilers with water and all steam and fire mountings in both cases. The advantage in a saving in weight to a shipowner I need not go into, but it may be well to remark that in some cases where there have been rigid limitations as to the length and draught of a ship it has only been possible to obtain the required speed by the adoption of water-tube boilers.

The space required is in no case more, and is in many cases less than required for the cylindrical boiler. By the installation of water-tube boilers in such a vessel as the Mauretania it would be possible to save nearly 12 per cent of the boiler floor space, representing about 50 ft. in length of ship, in addition to more than 2,000 tons displacement, and at the same time to increase the fire grate by about 35 per cent and the heating surface by nearly 40 per cent.

In the case of a typical mail and passenger steamer of 7,500 indicated horse-power, the installation of water-tube boilers would result in a gain in heating surface of 19 per cent., and in grate area of 23 per cent., and a saving in weight of about 300 tons and of floor space about 30 per cent.

The Princess Elizabeth, employed on the Belgian Royal Mail, Dover-Ostende service, had her eight cylindrical boilers taken out in 1914 and eight water-tube boilers, having 24 per cent. more heating surface and 43 per cent. more grate installed in their place. The saving in weight was about 68 tons, but in this case there was no gain in space, as it was preferred that the water-tube boilers should be as large as consistent with the available room. In service only seven of the water-tube boilers are used at one time, their output being fully equal to that of the eight cylindrical boilers.

Another interesting example is that of the large passenger steamer, Plymouth, owned by the Fall River Line. She is a paddle vessel with triple-expansion inclined engines, 50in., 75in., 81½in. by 99in. stroke, working at 25 revolutions per minute. She has six Scotch boilers. which are now to be taken out and replaced by water-tube boilers. There will be a saving in weight of about 156 tons, which will cause the vessel to float about 5½in. lighter, which difference in draught will have a marker influence on the revolution of engines and bring the vessel back to her original condition when she first went into service, the increased draught of water having been occasioned by safety appliances, extra piping, lifeboats, davits rafts, etc., and a multitude of devices placed on board since the vessel was first built.

The consumption of fuel is rarely greater, and then only due to inefficent stoking, and is in most cases less, and when oil fuel to be used, apart from the greater suitability of the furnace construction, the utilisation of the heat is better and there is a considerable saving as compared with the Scotch boiler.

The Antilles, Momus and Creole are sister ships of about 410ft. by 53ft. by 26ft., with a gross tonnage of about 6800, owned by the Southern Pacific Company, and employed on the same service at the same speed between New York and New Orleans. The coal consumption results from a long series of voyages are as follows:—

Antilles with cylindrical boilers, per round voyage, 1336 tons; Momus with cylindrical boilers, per round voyage, 1412 tons; Creole, with Babcock boilers, per round voyage, 1149 tons, that is to say, the water-tube boilered ship burned 225 tons less coal per round trip than the mean of the cylindrical-boilered ships.

The Rupara and Paringa are cargo vessels employed on Australian coastal service; the former has cylindrical boilers and the latter Babcock. The figures resulting from about 23,000 miles steaming are as follows:—

Mean.	Rupara, fitted with cylindrical boilers.	Paringa, fitted with Babcock boilers.
	tons	tons
Total displacement	1807	1700
Cargo carried	517	620
Coal per day	26.7	24.07
Indicated horse-power	1464	1333
Miles per ton	11.2	11.4

Thus the water-tube-boilered ship carried 20 per cent. more cargo and burned 9.8 per cent. less coal.

The following figures may also be of interest:—

The three vessels are owned by the South-Eastern and Chatham Railway Company, and employed on their cross-Channel mail and passenger service.

	No. of double trips.	Speed. Knots.	Coal per trip. Tons
ss. Victoria, fitted with cylindrical boilers	79	21.272	24.59
ss. Riviera fitted with Babcock boilers	111	21.868	24.58
ss. Engadine, fitted with Babcock boilers	94	22.367	24.77

When allowance is made for their increased speed, the ships with water-tube boilers show a considerable advantage in coal consumption.

A superheater can be readily applied, and it will be seen that it is simpler than the type usually fitted to cylindrical boilers, and does not in any way interfere with the cleaning of the boilers. In addition, the superheat can be regulated by an adjustable damper to a practically constant amount at sea and to a minimum when the boilers are used for auxiliary purposes in port.

As an instance of the efficiency which

has been obtained with oil-fired Babcock boilers and superheaters in conjunction with geared turbines installed in a mail and passenger vessel of 16,250 tons displacement and 19 knots speed. The following figures are given: —

Shaft horse-power	14,287
Oil for all purposes, per shaft horse-power	0.87 lb.
Steam pressure	221 lb.
Superheat	123 deg. Fah.
Feed temperature	185 deg. Fah.
Oil pressure	99 lb.
Oil temperature	106 deg. Fah.
Water for all purposes based on a pump efficiency of 95 per cent. only	11.65 lb. per S. H. P.

N. B.—In all probability the water consumption is underestimated, as the efficiency of a new pump is about 98 per cent.

Pound of water per pound of oil, actual	13.3
Pound of water per pound of oil, from and at 212 deg. Fah.	15.45
Calorific value of oil..	18,500 B.Th.U.
Boiler efficiency	81 per cent

In the stand-by boats on cross-channel service the ability of the water-tube boiler to raise steam quickly is a very valuable asset, in many cases rendering banked fires and their attendant losses unnecessary. Another advantage is that it can be installed on board without opening up any structural ship work. The funnel hatch is usually large enough to permit the steam drum and the various sections being lifted in, these being afterwards expanded together in place.

Many instances have occurred in which large expenditure of both money and time which would otherwise have been incurred for opening out and restoring ship work have been prevented by cutting up cylindrical boilers in the ship and installing water-tube in their place. It is sometimes urged against its use that the feeding requires special attention or special arrangements. As a matter of fact, the feeding arrangements recommended are merely those adopted in H. M. Navy years ago for boilers with the object of as far as possible eliminating corrosion. They constitute good practice and are advantageous with all types of boilers, and are not by any means special requirements for water-tube boilers.

The reserve feed water which has to be carried in the ship is the same proportion as that for cylindrical boilers of the same indicated horse-power, and this condition also applies to the evaporating plant to be fitted. Both reserve feed water and evaporators are now ordinary good practice for cylindrical boilers.

Victoria:—The Coughlan built "City of Vancouver" will load a full cargo of lumber for United Kingdom, after fitting out at False Cree. She will load her cargo at Puget Sound, and most of it is being shipped to Puget Sound from Tacoma.

AN ELECTRICALLY EQUIPPED SHIP

As is well known, almost the first place where electric light was used was on board ship; and Great Britain led the way in this application of electricity which made life at sea so much more healthy and pleasant. Since the early days when electric lamps and electric ventilating fans were practically the only uses on board ship, there have been many remarkable developments. In one of the latest liners launched from a British shipyard there is a very complete electrical installation. All watertight doors are operated and controlled electrically from the captain's bridge. There are two electrically operated lifts for the pantry; and amongst the service machinery there is an electrically driven apparatus for mixing the dough and for washing and peeling potatoes. The electrically driven gear also includes refrigerating fans, ventilating fans, and forced-draught fans for the boilers. The ship's whistle is automatically operated by electrical means from the captain's bridge and loud speaking telephones have been installed to assist in the navigation of the ship. Some interesting features are shown by a still larger British ship which recently went on her maiden voyage to America. This large vessel, which accommodates 2,200 passengers, is specially designed and built to burn oil fuel, and her turbines drive the propellors through the latest type of mechanical speed reduction gear. All the auxiliary machinery, such as winches, hoists, steering gear and cranes, is notable for being electro-hydraulic, thus representing a notable advance on former practice.

A REMARKABLE BARREL

When oil is carried across the sea in ordinary ships it is usually stored in wooden cases. The leakage from these cases is very considerable, and sometimes as much as a fifth of the oil will have disappeared at the end of the voyage. The attention of inventors has therefore been called to the problem of designing a barrel which will not leak. Success has been achieved by a British inventor who has designed a most ingenious barrel from which leakage is impossible. The first model cost the inventor over £1,000 but the barrel itself can be manufactured in quantities at from £3 to £4 each. The barrel is arranged in sections so that when empty it can be "nested" with a view to saving space. The adoption of this barrel is likely to become general in view of the high insurance rates charged for oil conveyed in the usual way.

NEW ANTI-FRICTION METAL

There are many special alloys for the purpose of lining the bearings of machinery so as to reduce the friction to a minimum. The objection to most of these is that if from any cause they should become hot the metal melts and runs out. This drawback is avoided in a new metal which has been tested in Great Britain with very satisfactory results. In these tests the metal became very hot without showing any signs of melting, and when forced lubrication was used the bearings showed no sign of wear or flow even with a load of over 1,000 lbs. per square inch.

TESTING TIRED METALS

It has been known for some time that metals are like human beings in getting tired after a prolonged exertion. A piece of metal, for instance, which is subject to constant vibration will gradually lose its strength, but will recover it again if it is allowed to remain quiet. Engineers, therefore, attach great importance to what is called the "fatigue testing" of metals. It is more important to know at what stage a piece of metal will become overtired and collapse than to know its hardness or its elasticity. The earliest forms of fatigue testing had the drawback that they took a considerable time and were therefore expensive. A British investigator has, however, devised a most ingenious apparatus by which the results of a fatigue test can be obtained in a few minutes instead of a week or two.

AN ELECTRICAL PIONEER

A link with the great Faraday who was the scientific founder of the electrical industry, has been broken by the death recently in England of Mr. S. A. Varley at the age of 90. Varley received his first inspiration from the lectures of Faraday at the Royal Institution, London, and he played an active part in the laying of the first Atlantic cable. During the Crimean War he laid, for the first time in military history, a field electric telegraph for war purposes. He was also the originator of the time ball at Greenwich Observatory and elsewhere for giving time signals visible to the public. Still more important was his invention of the compound wound dynamo.

OIL FUEL FOR SHIPS

At a recent engineering exhibition held in London, many forms of oil burner for marine and land purposes were exhibited, thus reflecting the rapid progress which has been made in converting coal-using British ships to oil burning. The pre-eminence which British engineering firms have secured in this field is illustrated by the fact that a large French liner has been equipped with oil burners by a British firm which, by the way, began its experiments in oil burning no fewer than 40 years ago. A special feature of the equipment is the means taken to ensure so efficient a mixture of oil and air that combustion is complete and the furnaces remain perfectly clean.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

PATENT BOILER ALARM

To all whom it may concern:

Be it known that I, John J. Hines, a citizen of the Dominion of Canada, residing at Halifax, in the Province of Nova Scotia and Dominion of Canada, have invented new and useful improvements in Boiler Alarms, of which the following is a specification.

My present invention pertains to boiler alarms; and it contemplates the provision of a simple, inexpensively installed and reliable apparatus, calculated in the event of the water in a boiler getting dangerously low to apprise the engineer of the fact so that he can have the boiler supplied with water before any damage takes place.

The apparatus is designed more particularly for use on a marine boiler and will be fully understood from the following description and claims, when the same are read in connection with the drawing, accompanying and forming part of this specification, in which:

Figure 1 is a view diagrammatic in character and showing the application of my apparatus to a marine boiler, and also showing that when a vessel is rolling or pitching in a heavy seaway there is practically no rise and fall of water in the center of the boiler where my novel apparatus is preferably located, particularly when the apparatus is used on a marine boiler.

Figure 2 is an enlarged vertical section of my novel apparatus.

Figure 3 is an enlarged view, partly in elevation and partly in vertical section showing the upper portion of the apparatus.

Similar numerals of reference designate corresponding parts in all of the views of the drawings.

The boiler 1 may be of any type, and in furtherance of my invention, a pipe 3, preferably of iron, and a column 2, preferably of brass, are connected with the boiler shell, the connections being effected, in the preferred embodiment of the invention, through the medium of a sandwich joint as best shown in Figure. 2, the said joint including flanges 4 and suitable connecting means 5.

When employed in a marine boiler, as in Figure 1, the pipe 3 extends downwardly through the steam and water space to the danger level of the boiler—i. e., about one inch above the highest heating surfaces, and I would also have it understood that the preferred arrangement of the pipe 3 is in the center of the boiler perpendicularly and longitudinally, this in order that the portion of the water adjacent to the lower end of the pipe will not be materially effected by movement of the ship.

The column 2 extends above and outside the boiler shell so as to radiate heat from the water contained in the column into the atmosphere, and in order to increase the radiating surface of the column, which is hollow, the said column is made in convolute form as illustrated.

The upper end of the column 2 is flanged, as indicated by 7, and to said flange 7 is connected by bolts 12 or other suitable means a closure plate 8.

At 17 is a container, preferably of copper, and in the said container is a mass 22 of mercury or equivalent material. The upper portion of the container, which upper portion is numbered 14, in Figures 2 and 3, is carried through the plate 8 and a gland 13 thereon, and may, when deemed necessary be insulated from the said plate and gland.

At 15 in the upper end of the container 14 is a plug of insulating material which is preferably threaded into an enlarged portion of the container as indicated by 16, and screwed in the said plug 15 is a terminal 19 designed to be connected with the plus pole of a source of electric energy (not shown). At 18, and bearing in the container 14 and contacting with the mercury is a complementary terminal designed to be electrically connected with the alarm or alarms (not shown) through the medium of which the engineer and other persons in authority are put on notice when the water in the boiler is dangerously low.

Under normal conditions, the boiler pressure operates to force water up the

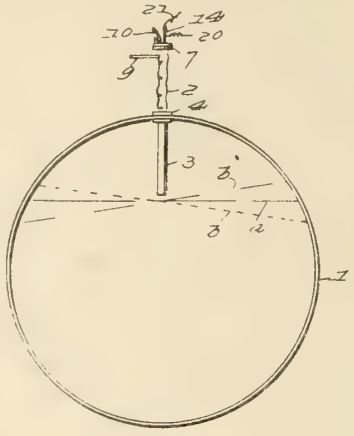

Fig. 1.

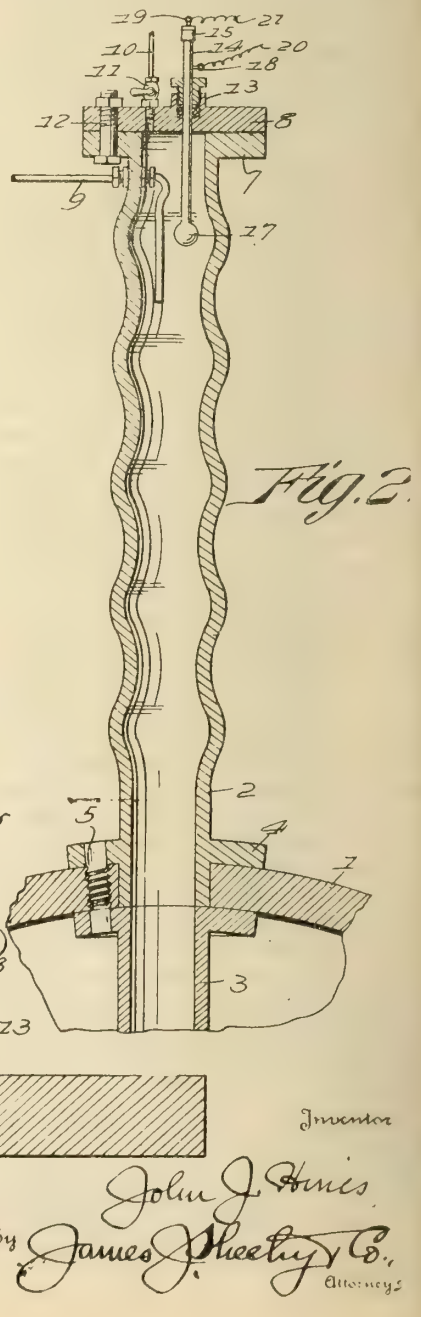

Fig. 2.

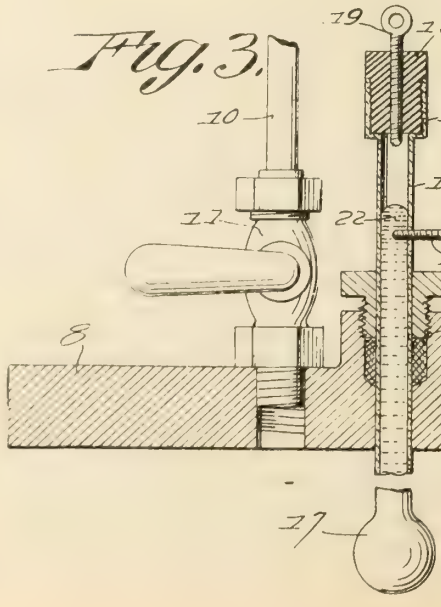

Fig. 3.

Inventor
John J. Hines
By James J. Sheehy & Co.
Attorneys

pipe 3 so as to flood the column 2 which, as before stated, is outside the boiler. This water being stagnant and in a column adapted to radiate heat into the atmosphere, it follows that such water will be considerably cooler than the water within the boiler, and consequently the heat given off by such water will not operate to expand the mercury 22 to any material extent. In the event, however, of the water in the boiler falling below the end of the pipe 3, the said pipe 3 and the column 2 will be immediately occupied by steam of high temperature, and in consequence the mercury will be quickly expanded and caused to electrically connect the terminals 18 and 19 whereupon the alarm or alarms will be sounded.

Inasmuch as my invention does not reside in the alarm or alarms, I would have it understood that without involving departure from the scope of my claimed invention, any signal may be employed to apprise those in authority that the water in the boiler is dangerously low.

When desired a cock 11 may also be employed on the plate 8, the said cock being connected to a small bore pipe 10. This pipe 10 may be carried downwardly and equipped with a second cock (not shown) within convenient reach of the operator so that incidental to the operation of getting up steam in the boiler, air may be exhausted from the pipe 3 and the column 2. It will also be noted that when the last mentioned cock is opened, during the operation of the boiler, the column 2 will be filled with water of the same temperature as that in the boiler and the electrical circuit will be completed to sound the alarm and enable the engineer to make certain that the apparatus is in good working order.

Also when desired, a small copper pipe 9, Figure 2, may be let from the feed pump side of check valve into the column 2, adjacent to the mercury container 14--17. By virture of this provision, feed water may be passed through the column 2 so that the temperature in the column will be the same as that of the feed water, and this condition will continue until the water level drops when by reason of the column being occupied by high temperature steam the circuit will be closed and the alarm sounded. It will be manifest that the feed water will pass through the said steam but will not appreciably diminish the temperature thereof.

Having described my invention, what I claim and desire to secure by Letters-Patent, is:

1. The combination of a boiler, a flanged depending conduit carried by the upper portion of the boiler within said boiler, an exterior hollow convoluted column provided with a flange portion at its top and a flange portion near its bottom and in alinement with said conduit, a closure plate secured to the flanged upper portion of the said column, a mercury container carried by said plate and depending within the column, a terminal secured to the container intermediate its length and normally in contact with the mercury therein, a second terminal carried by the upper end of the container and insulator therefrom normally resting out of contact with the mercury, and means for simultaneously securing both of the flanged portions of the conduit, and the column to the upper shell of the boiler in vertical alignment.

2. The combination of a boiler, a depending conduit secured to the upper portion of the boiler within said boiler, an exterior convoluted column secured to the upper portion of the boiler provided with a flanged upper end to which is fixed securely a closure plate, a mercury container carried by said plate and depending within the column, a terminal secured to the container intermediate its length normally in contact with the mercury therein, a secured terminal carried by the upper end of the container and insulated therefrom normally resting out of contact with the mercury, and a valved air pipe carried by the closure plate and depending within the interior of said column and leading to the atmosphere.

3. The combination of a boiler, a depending conduit secured to the upper portion of the boiler within said boiler, an exterior hollow convoluted column communicating in vertical alinement with and forming a continuation of said conduit and an increased radiating surface, a thermal circuit closing means positioned at the top portion of the column within the same, and a valved air pipe secured at the top of the column depending therein and leading to the atmosphere.

4. The combination of a boiler, a depending conduit secured to the upper portion of the boiler within the same, an exterior hollow column communicating with and forming a continuation of said column in vertical alinement therewith, a closure plate secured to the flanged upper portion of said column, a thermal circuit closing means carried by said plate at the upper portion of the column and depending therein and leading to the atmosphere, and a feed water pipe fitted into the top portion of the column and suspended therein adapted to maintain a uniform temperature within the column until the water in the boiler reaches the danger level.

5. The combination of a boiler, a depending conduit secured to the upper portion of the boiler within the same, an exterior hollow column secured to the boiler in vertical alinement with and forming a continuation of said conduit and increased capacity of radiating heat into the atmosphere; said column being formed of conductive material, valved means secured to the top of the column and in communication with its interior and the atmosphere, whereby air may be exhausted from both conduit and column thermal circuit closing means secured to the top of the column and depending therein, and a feed water pipe led into the top portion of the column adapted to prevent the temperature from rising within the column sufficient to cause an alarm before the water in the boiler reaches the danger level.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

JOHN J. HINES.

Witnesses:
Fred E. Lordly,
W. H. Wilson.

(Continued from page 19.)

pletion of three constructions left over from the liquidation of the Leclaire Shipbuilding Company.

This summer, the French Government sold four boats which had been begun at Three Rivers, to the Transportation and Shipping Company of Sorel. It will be remembered there was quite a lawsuit in connection with these vessels. One of these boats has just been received at Sorel and the other three are expected shortly.

The "Rapids King" which went aground in the Long Sault, on July 16th at which time she suffered considerable damage,is now at Sorel. She was repaired ed at Levis, at the Government dry dock, (Davies) where she was completely overhauled and given permanent repairs.

It is very unlikely that the Sincennes-McNaughten Lines will convert the "Dougaldmac" into a freight barge. Her engines and boilers have been pulled out in the meantime.

NEW BRITISH ENGINEERING PROJECTS

In spite of economic difficulties which are world-wide, serious attention is being given in Great Britain to many important engineering schemes. One of those is the construction of a ship canal between the Forth and the Clyde. Statistics have been placed before the Government with the object of proving that the construction of such a canal would attract a profitable volume of traffic. Another important scheme is the construction of a railway tunnel beneath the Thames at Gravesend with connections to the railway systems north and south of the river. The estimated cost of this tunnel is £6,000,000 (six million pounds) Steps are also being taken to re-organize the canal system of London, and important proposals were recently brought forward by a Government Committee.

Cowlishaw Walker and Co., London, Eng., have sent us an interesting catalogue which covers the subject of their bar coal cutter. Various details are explained, and the method of operation, dimensions of different parts and so on are given. The book is well illustrated and occupies 44 pages.

MARINE NEWS FROM EVERY SOURCE

Toronto:—The court of enquiry into the stranding of the "Sarnia" on Espinola Island found that the Captain of the vessel was not to blame. Captain Demers, the Dominion Wreck Commissioner, stated that if the enquiry had been held in England under the Board of Trade, they would have found that the lead should have been used. Captain Demers held that if the lead had been used Captain Johnston would have found the water shallower than he had reason to expect it to be, and would thus have known that he was off his course. The other commissioners however differed with Captain Demers on this point. Captain Johnston blamed the stranding on shifting currents, and a misleading sound from the Detroit fog whistle.

* * *

Rimouski:—The death is announced from New York of Mr. John James McWilliams, of Father Point, Que. Mr. Williams was for forty-five years the Dominion Government signalling agent at the Father Point station, and also acted as agent of the Shipping Federation, the Canadian Pacific Steamship Lines, and the Canadian Government telegraphs. In addition to this he acted as the correspondent for the Montreal Gazette, and the Toronto Mail and Empire. He was 67 years of age.

* * *

Ottawa: — The suggested Imperial Shipping Board is approved at Ottawa, providing that its functions remain of a purely advisory nature, leaving all legislation with the home Government. This is the opinion of the Department of Marine and Fisheries. The original plan was that the Board consist of eight members, a chairman appointed by the Crown, and a member each named by the Colonial Office, and the different Dominions. A permanent paid secretary was also recommended.

* * *

Sarnia:—The steamer "James Dempsey" arrived in the port of Sarnia with a cargo of lumber measuring over 900,000 feet. The cargo was consigned to McGibbon Ltd., and is the first lumber cargo to enter this port.

Hamilton:—The Hamilton Harbor Commissioners have for a long time been anxious to see their harbor a port of call for ocean going ships. They have received recently two communications from firms that do an overseas trade, asking what facilities the port of Hamilton had to offer. The firms interested were the Alfred C. Jackson Steamship service, and the Maythan Towing Co.

* * *

Montreal:—There were on Sept. 13th in the harbor of Montreal no fewer than 74 steamers loading and unloading, 66 of these being ocean going ships, the remainder being coasters.

* * *

Victoria, B.C.:—The "Canadian Importer" arrived in this port after being given up for lost at various times during the past few weeks. The vessel which had a very heavy list, was in tow of two tugs, the salvage vessel "Algerine" convoying her a few cables lengths astern, while the "Canadian Observer" was astern of the "Algerine." The extent of the damage will be ascertained when the vessel is dry docked. The eleven men under the second officer, Mr. Laird, who volunteered to go for assistance, were fourteen days sailing before they were picked up, and at that time were within 100 miles of their destination.

* * *

Brockville:—One of the best known lake and river captains dropped dead aboard his motor boat when opposite his summer home. The deceased was Frank Lum, seventy years old, and for many years with the George Hall Coal Co. He was engaged in making some repairs to his engine when death overtook him. He leaves a daughter and two sons.

* * *

Detroit:—A party of gentlemen who had gone for a cruise on Lake St. Clair in a 45 foot cabin cruiser had a nasty experience when the little vessel took fire and forced them to abandon her in the middle of the lake, and reach shore by means of the dinghy. The cruiser was burned to the water's edge.

* * *

London:—The British Admiralty have reported that the Bight of Heligoland has now been cleared of floating mines by the Germans, according to the conditions of the peace treaty. The waters all around the British Isles are now cleared, and a large part of the Mediterranean, only a small portion around the coast of Albania being still uncleared. Generally the waters of the earth are being denuded of these menacing dangers.

* * *

Sault Ste. Marie:—The body of Captain John Lohr of the steamer Maytham was found in the St. Mary's River, after the captain had been missing for about 24 hours. He left his ship to go and clear her through the customs, and to telegraph the owners at Cleveland, and was never seen alive again. It is said that he was subject to occasional fainting fits, or weak spells, and it is surmised that he fell into the water during one of these seizures.

* * *

Ottawa:—In a report to the Minister of Trade and Commerce, the deputy minister, Mr. O'Hara, criticizes Canadian transportation firms. He says that a great deal of the criticism that is levelled at the Canadian exporter should be directed at the transportation companies, who show a lack of appreciation of the demands of the export trade. Due to this some exporters have declared their intention of shipping through New York instead of Canadian channels.

* * *

Montreal:—Third class passenger rates from Montreal to Continental destinations have been reduced by $25, the reduction to come into effect at once, according to a large steamship office here. The reduction will also come into effect on the steamers of the company sailing from New York.

* * *

Montreal:—The congestion that has existed in the port of Montreal has now become a thing of the past, with all the grain handling facilities of the port working to capacity. Much of the delay experienced was due to the non-arrival of particular grades of wheat, and this has adjusted itself.

S. S. "NORTH SHORE"

The S. S. "NORTH SHORE," passenger and cargo vessel operated by the Clarke Steamship Company, Ltd., of Quebec, recently gutted by fire, has just been constructed by Canadian Vickers, Limited, to the designs and specification of Walter Lambert, Naval Architect, Montreal, the work being carried out under his personal supervision.

On completion a luncheon was given on board at Quebec by the owners, the guests being Sir George and Lady Foster, Premier Taschereau, of Quebec, and other distinguished visitors. The vessel later sailed for different points in the Gulf, having as passengers, amongst others, Sir George and Lady Foster.

BUYERS' DIRECTORY

ARCHITECTS, NAVAL
John Reid & Co., New York.

ANCHORS
Thos. Davidson Mfg. Co., Ltd., Montreal, Que.
Hopkins & Co., F. H., Montreal, Que.
Taylor & Sons, S., Brierly Hill, Eng.

ANEMOMETERS
Taylor Instrument Companies, Rochester, N.Y.

ANVILS
Thos. Davidson Mfg. Co., Ltd., Montreal, Que.

ASH EJECTORS
Row & Davis Engineers, Inc., New York, N.Y.

ASH HANDLING EQUIPMENT
Dake Engine Co., Grand Haven, Mich.
F. H. Hopkins Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Row & Davis Engineers, Inc., New York, N.Y.

BAR IRON
Mitchells Ltd., Glasgow, Scotland.

BAROMETERS
Taylor Instrument Companies Rochester, N.Y.

BEARINGS, BRASS
Mitchell Co., The Robert, Montreal, Que.

BELLS, SHIPS, ENGINE ROOM, ETC.
Morrison Brass Mfg. Co., James, Toronto, Ont.
R. C. Miller Oil & Supply Co., Montreal, Que.

BELTING, RUBBER
R. C. Miller Oil & Supply Co., Montreal, Que.

BINNACLES
Hopkins & Co., F. H., Montreal, Que.
Morrison Brass Mfg. Co., James, Toronto, Ont.

BLOCKS, CARGO, HEEL AND TACKLE
Hopkins & Co., F. H., Montreal, Que.

BLOWERS
John Reid & Co., New York.

BLOWERS, TURBO-
Mason Regulator & Engin. Co., Montreal, Que.

BOAT RAILINGS
Canada Wire & Iron Goods Co., Hamilton, Ont.

BOILERS
W. M. Beardmore & Co., Montreal, Que.
John G. Kincaid & Co., Ltd., Greenock, Scotland.

BOILER CLEANING EXTRACT
R. C. Miller Oil & Supply Co., Montreal, Que.
Darling Bros., Ltd., Montreal, Que.
F. H. Hopkins Co., Montreal, Que.

BOILER COVERINGS
R. C. Miller Oil & Supply Co., Montreal, Que.
Crane Ltd., Montreal.

BOILER MAKERS
New Burrell-Johnson, Yarmouth, N.S.

BOILER MOUNTINGS
Jenkins Bros., Montreal.

BOILERS, MARINE
Can. Vickers, Ltd., Montreal, Que.
Doxford & Sons, William, Sunderland, England.
Engr. & Mach. Wks. of Can., St. Catharines, Ont.
Mason Regulator & Engin. Co., Montreal, Que.
Ross & Duncan, Govan, Scotland.

BOILERS STEAM
Engineering & Machine Works of Canada, St. Catharines, Ont.
New Burrell-Johnson Iron Co., Yarmouth, N.S.

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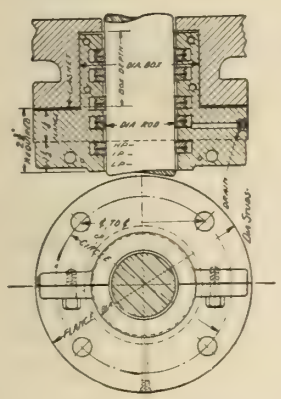
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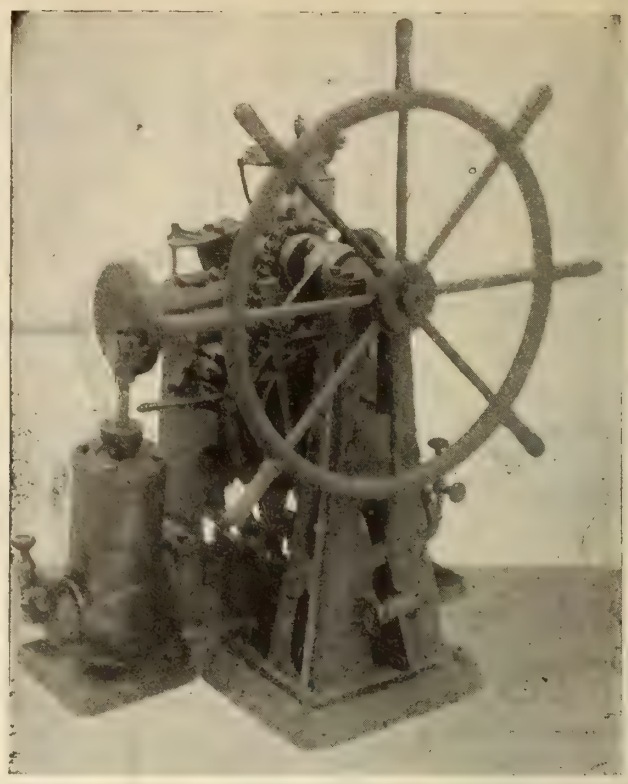

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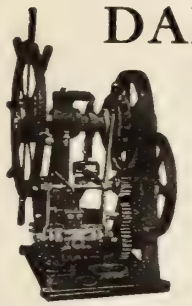

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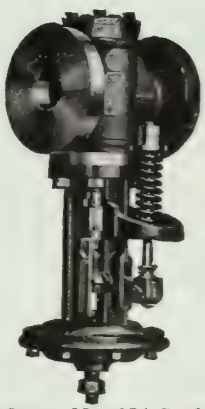

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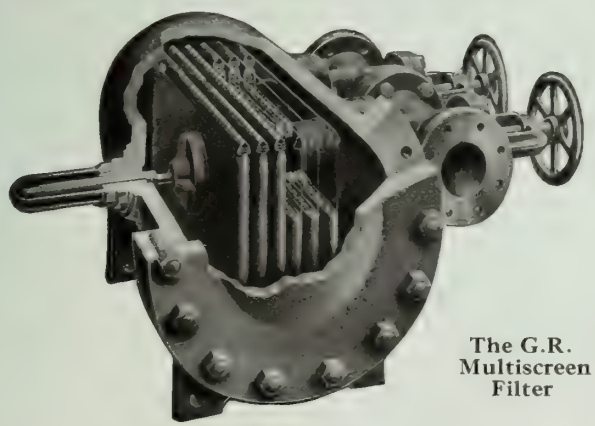

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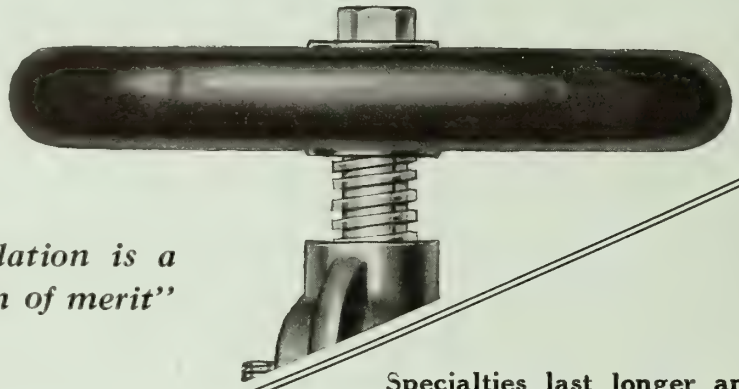

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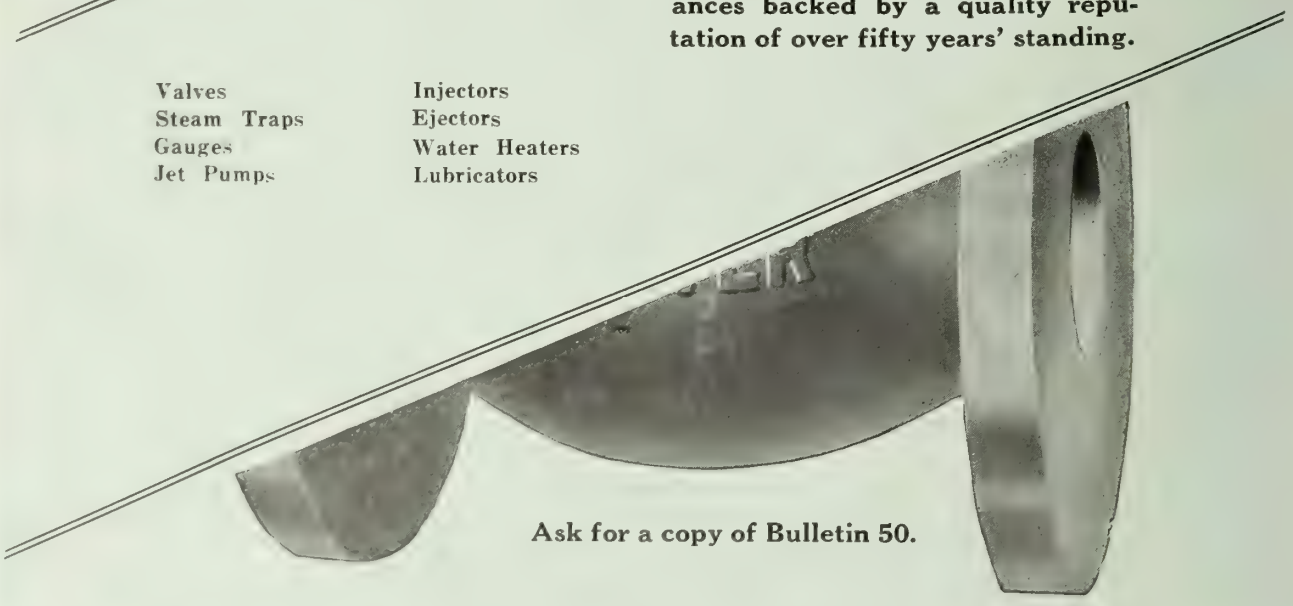

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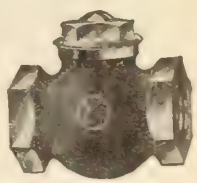

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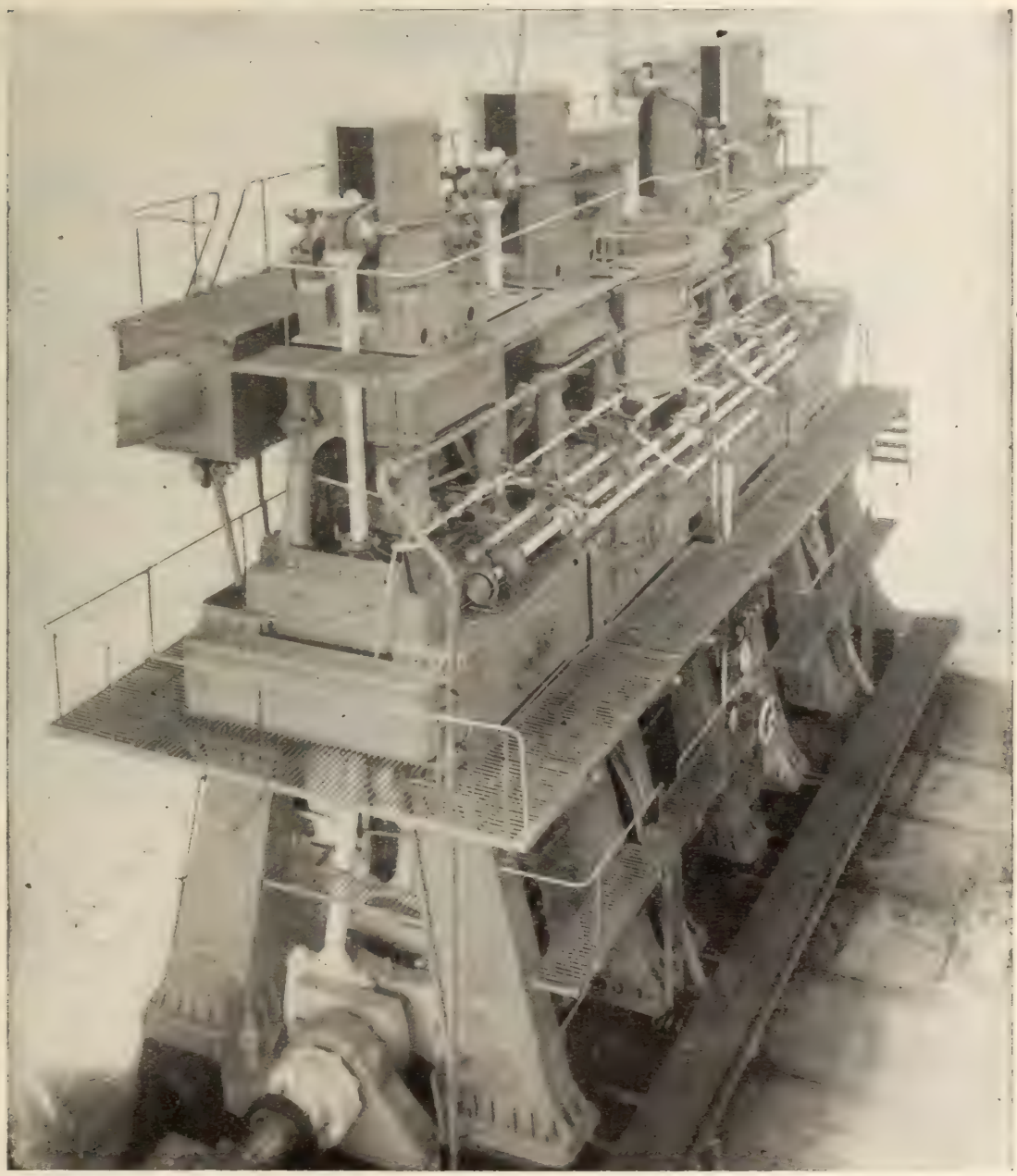

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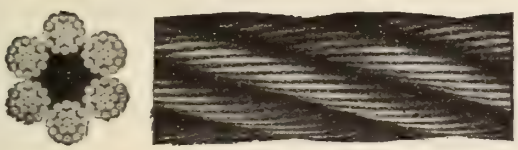

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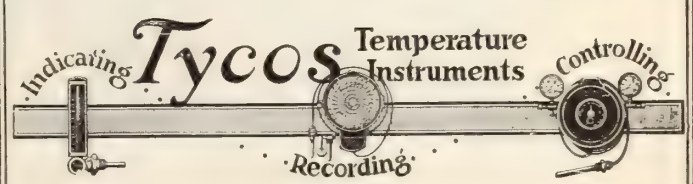

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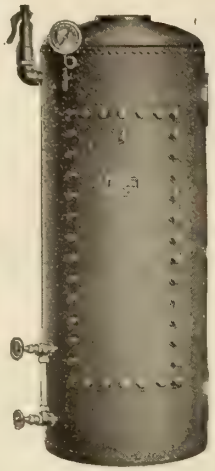

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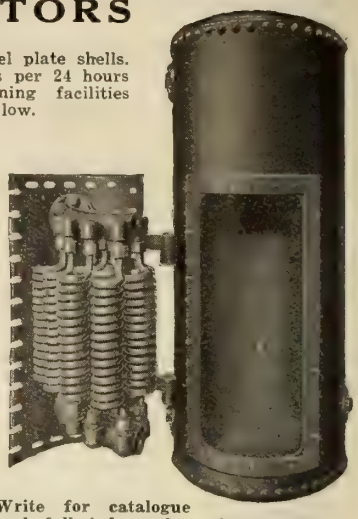

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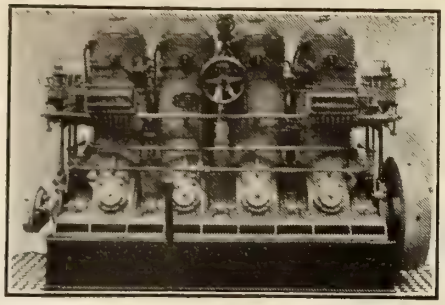

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Volume XI OCTOBER, 1921 Number 10

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By A. KEENS*

DURING recent years the use of oil fuel has become very general and is now on an established footing in the commercial world. Old methods die hard, and so far as the firing of boilers is concerned, coal has fought gamely for the premier position, but has had to bow to the inevitable, for coal is a very poor second to oil in this direction.

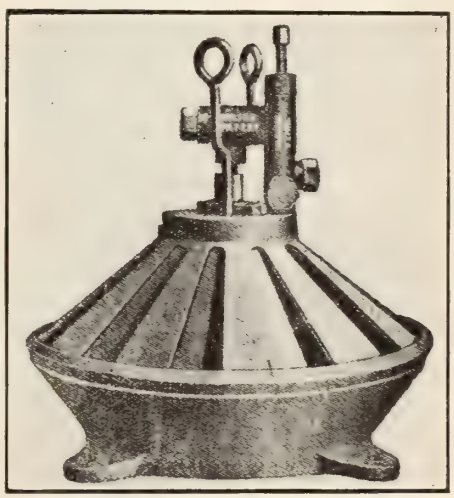
Before proceeding further, it is perhaps desirable to enumerate some of the advantages possessed by oil fuel at 20,000 B. T. U. per pound of oil. There is a saving in deadweight, dependent on conditions. One ton of oil will give the same results as 1-6 tons of coal, and one ton of oil occupies about 38 cubic feet, against 44 cubic feet per ton of coal. A better and quicker regulation of furnace can be effected and stoke-holds can be kept scrupulously clean. An extremely uniform circulation of boiler water is maintained owing to the regular heat and uniform distribution. With oil fuel there is no corrosion of splash plates, flooring plates, boiler fronts, etc., and bilges are kept extremely clean. There is no loss of steam when cleaning fires, and no ashes to handle. The bunkers in hand can be quickly and accurately measured up without any fear of unseen empty spaces. Fewer firemen are required and hard manual labour is eliminated. The steam is under perfect control, and a sudden call for extra power and speed can be met with certainty, and in a very short time. This has been well demonstrated during the recent war, when ships have, in times of necessity, attained a speed that was considered impossible, and far in excess of the trial speeds of each particular vessel. The calorific value of oil fuel can be easily worked from the specific gravity, and with very close results to the experimental tests. Bunkering is carried out with great rapidity and without any of the objectionable features found in coal. This is a great advantage to passenger ships, etc., where privacy and cleanliness is a consideration. The methods of burning oil fuel are numerous and varied, but the object of all systems is the same: To abstract the greatest amount of heat from a given quantity of fuel with a minimum of cost and trouble. The initial cost of any oil system is fairly heavy, but onse installed, the working costs are remarkably low.

The latest method of burning oil fuel, with either forced or natural draught, is to supply the oil under pressure and at a fairly high temperature to the burners, and without the use of steam as a pulverising agent. To convey a thorough grasp of the subject, I will endeavour to give a description of the various requirements necessary on board ship, to fire boilers with oil fuel.

Storage Spaces

The spaces usually utilized on board ship for the storage of bunkers, are:—Forepeak cross-bunker, after-peak, and sometimes double-bottom tanks. Under certain conditions the cofferdams (if any) may also be used. They are connected by suitable piping for filling purposes, and also for the transference of oil from one space to another. These spaces must be thoroughly washed out, and be absolutely clean before taking oil into them, and they must be carefully measured and tabulated for every three inches. If there is a connection to an ordinary ballast pump, the pipe must be blank-flanged to prevent any possibility of an accidental discharge of oil, or of any oil finding its way into the bilges. The cross bunker usually serves as the direct suction tank to the boilers, when this is so, a low suction pipe is fitted that reaches within four inches of the bottom of the tank alongside this there is another pipe called the high suction pipe, this pipe terminates about four feet from the bottom of the tank, the opposite ends of these pipes are jointed to the stokehold bulkhead and are connected to master valves. Extension spindles reach from these valves to the deck, and admit of the oil being shut off in cases of emergency, without having to enter the stokehold.

Except in cases of a fuel shortage, the low suction pipe is never used, the high suction is in constant demand as it ensures a freedom from water. There are also two very smal pipes fitted, one at either side, the ends of which reach down to within one inch of the tank bottom, the other ends of these pipes are also attached to the stokehold bulkhead so that any accumulation of water in the bunker tank may be drained into the two after divisions of the side bilges. These divisions of the side bilges are isolated from the rest and any mixture that may be present is pumped out by the pressure pumps. Connected with



Natural draught cone front.

these drain pipes and direct on the stoke-be taken to prevent water finding its fitted with locks; this prevents accidental manipulation. Every precaution must be takento prevent water finding its way into the bunker spaces, so that any sea connection, suction or delivery pipes connected with such spaces must be blanked off, that is to say, any not connected with the fuel pumps. All fuel pipes connected with the storage spaces are, as a rule, adaptable either for suction or delivery.

Steam Heating Coils

Heating coils for warming the oil in bunker spaces are fitted around the suction pipes in all tanks, and are used in cold weather or when the oil is very dense. The coils should be made of solid drawn copper or steel tubing, copper for

*Transactions of the Institute of Marine Engineers.

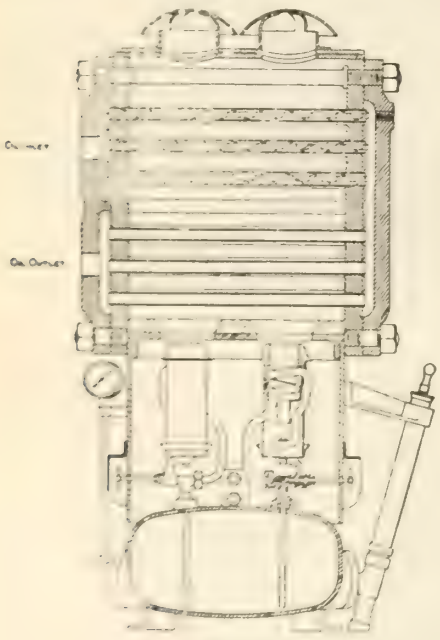
preference, as steel often has defects after being worked in the fire, and is subject to corrosion. All exhausts from the heating coils and steam fuel heaters are not led direct to tthe condenser, but are first passed through a sight feed tank, this enables one to detect any leakage of oil through the heating systems to the condenser. This sight feed tank will be referred to later.

Suction Filters.

As a rule there are two large filters on the suction side of the fuel pumps, the filtering medium being of fine brass or copper gauze wrapped around perforated brass drums and are so arranged that they may be used either separately or together. When used separately, one is in use while the other may be cleaned.

Suction Heaters

There are usually one or two suction heaters that are fitted between the suction filters and the oil fuel pumps, they are of various designs, and having straight or spiral tubes, with steam inside or outside. These tubes are sometimes made of copper or brass, but often solid drawn steel tubes are used. The most efficient heater at the present time seems to be not unlike a small circular condenser, both in appearance and design, and consists of a number of thin planished steel tubes running from end to end and expanded into two tube-plates, and the oil enters at one end and passes through the tubes and back again through the return tubes, leaving by the



Oil Heater

same end as it entered. The heaters may be fitted either horizontally or vertically. The oil takes a very high temperature whilst passing through this type of heater and a temperature of 350 degrees can be maintained with an exceptionally low steam consumption.

With the older types of fuel heaters, it was impossible to maintain such high temperatures, and heavy fuels, such as Urgurda, Mexican and the like, could only be burned with an element of danger, and considerable worry to those responsible.

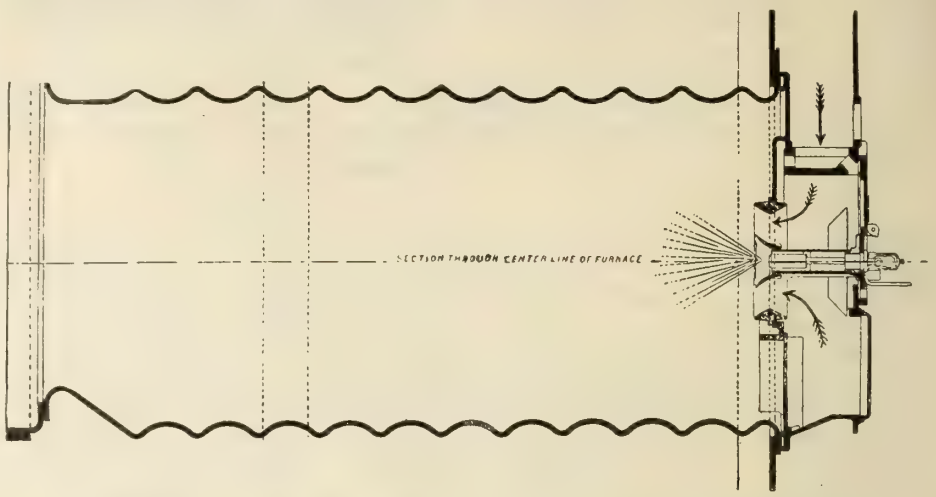
Oil Fuel Pumps: Pressure Pumps.

It is usual to fit two pumps side by side, sometimes they are of the duplex type, there are also special pumps other than duplex pumps which are specially designed to supply oil to the burners. Whatever the design of the pumps, they must be absolutely reliable, and capable of working at very low speeds without sticking. They are, as a rule, fitted with deep double pistons so as to prevent piston leakage as far as possible. When fitting oil fuel pumps, it is important to see that the seating of the pumps is constructed in such a manner that the drainage of oil from the glands, etc., will not find its way into the bilges. In many cases, a tray is fitted underneath the pumps, and the drainage is carried away by a small pipe to the two after divisions of the side bilge, which have been mentioned before in connection with the water drainage pipes from the cross bunker. In connection with these pumps, there is a very elaborate system of pipes and valves which gives the engineer in charge a number of alternatives should any part fail.

Delivery Heaters

There are usually one or two of these heaters fitted on the delivery side of the pumps, and are of similar design and capacity to the suction heaters. As a rule the connections are so arranged that it is possible to use the suction heaters on the delivery side also. The heaters are so arranged that they may all be used together, or the oil may be led direct to the burners without using any heater, The heaters can thus be cleaned if necessary while the system is at work.

Two filters are usually fitted on the delivery side of the pumps and after the delivery heaters, these are of similar piece to each boiler, and around the top-



Arranged for White system of forced draft fronts. Note absence of brick work.

construction to the suction filters, but considerably smaller. The filtering medium is of very fine brass or copper gauze, and the connections to and from these filters are such that they can be used together or separately.

Piping Holders And Burners

The oil is led direct from the delivery filters to a branch piece, pipes, usually of 1 in. diameter are led from this branch side of each furnace front. Small pipes of about ½ in. diameter are led from this boiler front main supply pipe to the holders, there may be any number from four down to one. These branch pipes are connected to the main pipe by a valve, and each terminates at the holder with a valve, so that there are two stop valves between the burners and the oil supply. On the opposite end of the boiler front main supply pipe there is another stop valve. This valve, when open, allows the oil to pass back to the suction side of the fuel pumps, and will be referred to later, in connection with the circulation of oil before lighting up. The holders are bolted on to the furnace fronts, and are so designed that the burners can ge fitted or adjusted with great rapidity, and the joint reliably made without any especial care or preparation on the part of the attendant.

The burners fit the holders with a spigot and faucet joint, or sometimes ball joints are used. They are of various lengths according to circumstances, a usual length being 12 to 15 ins., they are sometimes fitted with adjustable ends so that the length may be regulated to suit conditions. The burners are of various designs, some of which use steam in conjunction with the oil for pulverising purposes. The later tendency, however, is to do away with the assistance of steam in this direction, as the steam consumption is a serious item, and the results attained do not appear to be any better than the simpler burner. This later burner, terminates with a screwed nozzle end, which has a very small hole drilled through the centre and coned inside to take a spraying de-

vice. The spraying devices are numerous and consist of two types; automatic and adjustable.

Gauges And Thermometers

Pressure gauges are fitted to the delivery side of the pressure pumps, combination gauges, indicating pressure or vacuum, are fitted to the suction side of the pumps, thermometers are fitted to each heater, and also each boiler front, sometimes one or more may be fitted along the line. By this arrangement, the temperatures and pressures are always in prominence, and the gauges on the suction side of the pumps are particularly valuable in detecting dirty suction filters and heaters.

Drip-Trays

Brass or tin drip-trays rest upon the stokehold platform and under each furnace front. When changing burners the droppings of oil fall into these trays and the platform and stokehold tanktops are kept free of oil.

Sight-Feed Tank

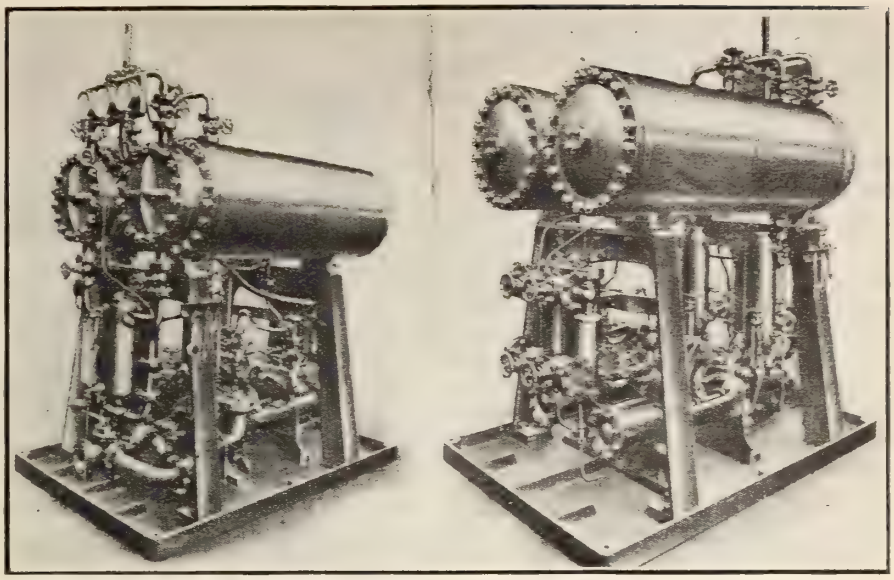
The exhaust steam from the suction and delivery heaters, and also from the heating coils in the oil storage spaces are led to the sight feed tank. This sight feed tank is divided into several divisions and is usually filled with coke, the condensed water from the heating arrangements is passed through this coke, and is finally led to the hotwell, the coke holding any small amount of oil that may be held in suspension by the water whilst passing through. Should oil be noticed on the surface of the water of the sight tank, it indicates that some part of the heating system is leaking, the discharge to the hotwell is then changed over to the bilges until the leak is remedied. Connected directly on to, but before the tank, is a small chamber which is fitted with a gauge glass; this greatly facilitates the detection of an oil leak.

Settling Tanks

With the prevailing systems, settling tanks are not necessary, as the fuel is fed under pressure to the burners. With the older methods of burning oil fuel, they were extensively used for gravity feed, and for separating the water from the oil, a temperature of 180 degrees F. being necessary for this purpose. With the pressure fed systems they are considered more dangerous than useful. It was usual to arrange these settling tanks directly above the boilers to keep the oil hot by natural conditions. Where the bunkers are carried in double bottom tanks, two settling tanks of small size may be an adantage, owing to the difficulty of eliminating water usually found in double bottom tanks.

Transfer Pumps

On the larger ships it is usual to fit a large transfer pump in addition to the two pressure pumps, this pump is connected with the general fuel arrangement, and is used for transferring the bunker oil from one storage space to another, thus leaving the pressure pumps to deal solely with the delivery of oil to the burners. The transfer pump is, as a rule, of the same design as the pressure pumps, and may be adapted in cases of emergency for feeding the oil to the burners but is not fitted on board for that purpose nor is this part of its duties. I think that now all the machinery that is required for oil burning in boilers on board ship has been enumerated, and in the other as fitted. The preparation and alterations required by boilers in order to use oil fuel will be now dealt with.



Smith patent duplicate unit oil burning installation.

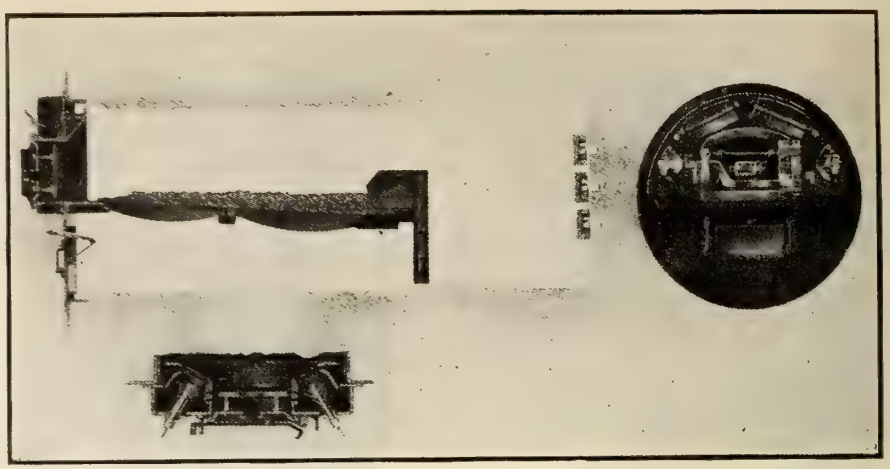
Furnace Fronts

The alterations and additions connected with furnace fronts vary considerably. The oil may be burnt under forced or natural draught and arranged so that the furnaces may be converted to coal burning in a very short space of time. On the other hand the fronts may be fitted for the permanent burning of oil fuel. In another method that has lately been used the boilers may be fired with oil or with coal, or a combination of oil and coal may be used, without any alteration being necessary under any of the conditions. For burning oil fuel permanently, under natural draught, the furnace front is an entirely different arrangement to that used for coal, and consists of two parts, an upper, and (for the ashpits) a lower, and the whole is bolted to the furnace mouth in an airtight manner. The upper part takes the holders, burners and circular dampers, the lower part takes one or sometimes two circular sleeve dampers. These dampers are so arranged that they can be fixed at any desired opening, and when not required can be shut in a thoroughly airtight manner. The making of the fronts in two parts enables a man to enter the furnace without having to dismantle the entire front. With forced draught it is usual to use the original furnace fronts but to fit new doors. To these doors are fitted the burner holders and burners and a movable sight door that may also be used for the introduction of the torch when lighting up. As may be gathered from this arrangement, should it be necessary to change back to coal burning it is only necessary to change the doors. In certain cases the conversion from oil to coal or vice versa may be carried out in remarkably short time, a case is on record where a ship, under this arrangement, completed a conversion from full-speed on coal to full-speed on oil in 28 minutes. Another late system is such that a special furnace front is fitted. With this front, oil, coal, or a combination of both may be used without any alteration being necessary. In this case the door is of similiar design to the usual coal door and fitted with a device for locking the door when necessary. The burners are let into the side of the furnace fronts at an angle and are fitted permanently. One burner at each side is the usual arrangement. In all cases of oil fuel burning, the furnace fronts inside and front bearer plates are covered with firebricks. This allows the flame to play freely against the inside of the fronts, and prevents them from getting unduly hot. It may be stated that a great change has taken place in the construction of furnace fronts during recent years, five or six years ago, massive fronts of intricate construction and heavy weight, and made of cast iron could often be seen, whereas to-day the fronts are of comparatively light weight simple construction and usually made of light steel plate.

Furnaces And Combustion Chambers

When burning oil fuel permanently, all the firebars, bearer plates, bridgeplates etc., are entirely removed and the furnaces and combustion chambers pre-

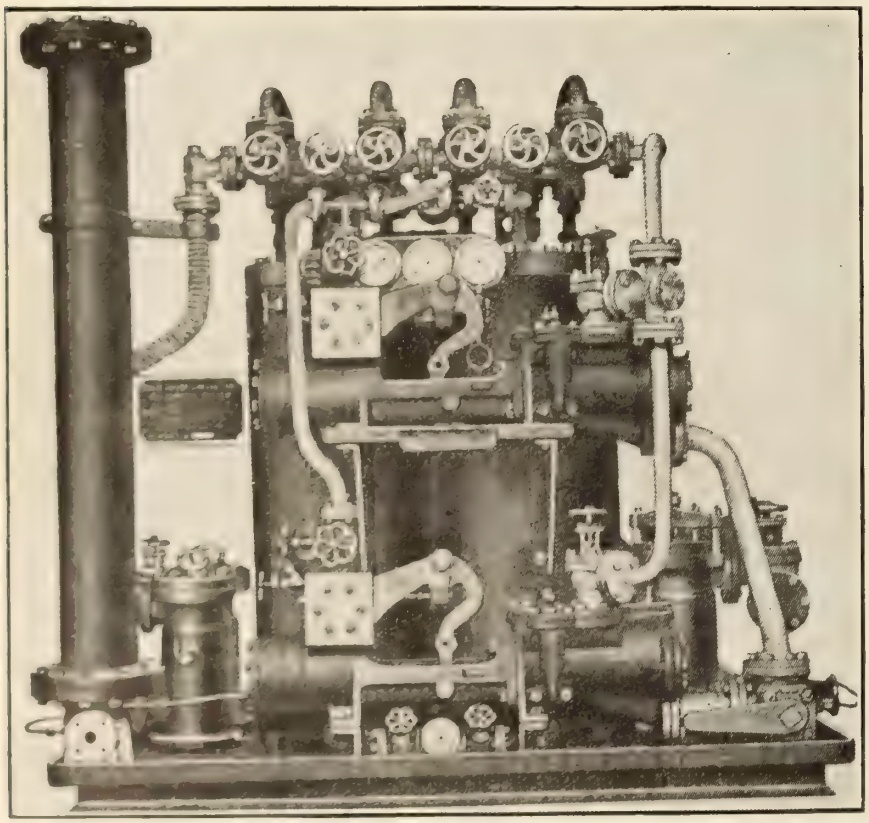
pared accordingly to requirements. There seems to be a great diversity of opinion amongst engineers regarding the amount of brickwork that it is advisable to build in the furnaces and combustion chambers for protective purposes. In some cases as many as 1200 bricks or even more may be required per boiler, on the other hand and under similiar circumstances there may be very few firebricks or fireclay used. When bricks are used, either with forced or natural draught without firebars, they are usually used in the following manner: striking pillar is built somewhere about the centre of the furnace, having its foundation on the furnace bottom, extended and fitted to the furnace crown, any studs projecting into the furnace must be liberally covered with fireclay to prevent them from being burnt off. The back-end of the furnace is bricked up over the seams and wedge bricks are used for the top, these wedge bricks form the seating for the saddle seam bricks, this protection for the saddle seams is carried up as far as the bottom row of tubes. For the combustion chamber the bottom, sides and back are bricked up to about 18 inches above the furnace top. This covering is about 1 inch from the surface of the plate. With the quick converting system or combination system, the firebars are left in, and the back bridge plate is well covered with firebricks at both sides. The firebars are covered with broken firebricks, and a striking pillar may be built with its foundation on the firebars. When the firebars are left in, it is necessary to observe that sufficient air is admitted underneath the bars to prevent them melting. The furnaces and combustion chambers may be fully or partly bricked up and the striking pillar may or may not be fitted according to the individual experience and ideas of the engineer in charge. The variation of opinion often leads to very interesting discussions. It would appear that the striking pillar, owing to the gasses impingeing upon its surface and being delayed in passing through the furnace, must naturally aid combustion in the furnace and slightly reduce the combustion chamber temperatures, thus adding to the general efficiency. After being in use for a short time the pillar assumes a white heat in direct contact with quite a large area top and bottom of the furnace. This may have some weakening effect on that portion of the plate in direct contact with the pillar, and this may vary according to the thickness of scale on the furnace, and it is only natural to suppose that there would be more scale on those particular parts than any other; also, corrosion, similiar to that found on the line of firebars might reasonably be expected, this does not, however, appear to be borne out in practice.



The Smith patent combined oil and coal burning furnace front for natural or closed stokehold draught.

Pumping Arrangement

The usual arrangement enables the fuel pump to draw the oil direct from the suction tank, or, through one or both suction filters, or, through one or more suction heaters, and enables the pumps to deliver direct to the burners, or, through one or both delivery filters, or, through one or more delivery heaters on the way to the burners, or, any combination of filters and heaters. By the aid of a by-pass valve or valves (there is one fitted to every boiler front) it is possible to deliver the oil back again to the suction side of the pumps, thus the oil may be circulated through the system, with or without delivery from the burners, and this is the method employed to heat the fuel before lighting up. The fuel pumps may be worked separately or in series, or one may be working whilst the other is at rest. When worked in series, one may be used to draw the oil from the tank through filters and heaters acording to requirements, the second pump drawing the oil from the delivery side of the first pump and delivering it to the burners through the necessary heaters and filters. When the pumps are worked both at once, but separate from each other, one may be drawing oil from the tank and delivering it to the burners, whilst the other is used for transferring the bunker oil from one storage space to another. From this arrangement it will be seen that both pumps may be connected to each



Complete duplex unit installation. Any pump, heater, or strainer can be readily overhauled without interfering with the operation of the system.

other and may have a common suction and delivery pipe, or they may be isolated from each other so that one may be in use and at the same time the other may be overhauled.

As previously stated, and as may be gathered from these recent remarks, the piping arrangements connected with these pumps is very elaborate, while by the manipulation of cocks and valves the suction side becomes the delivery, and vice versa, added to by different combinations, yet it is possible to prove the practical value of this method. One rather interesting result of this arrangement is that by making the overboard discharge pipe from the fuel pumps into the suction pipe, and connecting a flexible pipe to it, it is possible to discharge a lighter that has brought fuel oil alongside, and pump it into any, or all of the bunker spaces in the ship with the ship's own fuel pumps. This is of undoubted value where, in isolated cases, a lighter of bunker oil arrives without any provision made for discharging it.

Lighting Up Without Steam

With every oil fuel system there is fitted an arrangement which enables the fires to be set away without any steam being available. This arrangement consists of a hand-pump which draws its oil from the usual connections and delivers it through a small heater which derives its heat from parrifin bunsen burners. Connections may be shut whereby practically only the pipes on the boiler fronts are in connection with the hand-pump. Preparatory to lighting up, the circulating valves are opened and the oil is circulated around the hand pumping system and heater; when the oil has reached a suitable temperature the circulating valves are shut and the pressure increased, a torch is then introduced into the furnace and the oil is turned on; should the temperature and pressure be satisfactory, it will blaze readily. The pump will continue to be worked by hand until sufficient steam has been raised to enable the steam pumps to be put into action. When the hand pumping system is not in use, certain valves are closed, thus isolating it from the steam system and fuel supply tanks.

Lighting Up When Steam is Available

When steam is available, the by-pass valves are opened, the pumps are started, and the oil circulated round the system and steam heaters until it assumes a suitable temperature, the torch is then introduced into the furnaces. In all cases the pressure maintained by the pumps must be kept as low as possible consistent with good combustion.

Stokehold Necessities

The articles required in the stokehold are:—

Torch.—This is usually of the ship-made variety and consists of a piece of half or three-quarter inch iron rod about four feet long, the end is bent over and hpunyarn or marline is wound round it in the form of a small ball, and secured.

Kerosene.—A vessel containing about half-a-gallon of kerosene is kept handy for the purpose of cleaning the burner nozzles and spraying devices, and also for the purpose of soaking the torch.

Water.—A bucket of salt water is kept on the platform for the purpose of quenching the torch after use, and for cooling the burners before cleaning.

Sand and Chemical Fire Extinguishers.—A large sand tank is fitted in some convenient place handy for use, and chemical fire extinguishers should be fitted, one large one at either side would perhaps prove advantageous.

In the majority of cases a liberal supply of spare burners are kept in a rack ready for immediate use

A system of steam fire extinguishing pipes is fitted above the stokehold tank tops and underneath the boilers. These pipes are of about 2 inches diameter, and are led in different directions according to the ideas of the designer. The ends of these pipes are plugged up, and a number of small holes (about quarter inch diameter) are drilled in such a manner that the whole surface of the tank-top and bilges may be swept with a continuous steam blast. The usual custom is to take the steam direct from the boilers, and an extension spindle from this valve is led to the deck, and enables the steam to be turned on in cases of emergency without having to enter the boiler or engine rooms. Suitable spanners, drip-trays, vice-bench, etc., complete the requirements.

Observations and Comments

To get the best results from oil fuel requires a certain amount of experience and thought. Oil fuel may be burnt in such a manner that combustion is to our present ideas, perfect, and without a sign of smoke. On the other hand, the smoke may be so dense and black as to leave a trail in the sky extending for several miles behind the ship. In certain cases of converted ships, the elimination of smoke has presented quite a difficult and insurmountable condition, even to the minds of engineers thoroughly experienced and conversant with oil burning. From experience it would seem that unsatisfactory combustion and consequent black smoke may arise from a great variety of causes, and is not cured quite so easily or simply as some authors of books would give us to understand. It has been found that providing the boilers and fittings are satisfactory the burning of the average oil fuel usually supplied may be carried out with entire satisfaction at a temperature of about 200 degrees F.: an oil pressure of from 15 to 40 lb. usually being necessary to give smokeless combustion. These conditions do not of course, meet every case, and it is a matter of experience to hit upon the correct combination of conditions quickly, for there is a great variation. With particularly dense oils it has been found that an oil temperature of 300 to 350 degrees F. and a pressure of 70 lb. or thereabouts is required to burn them efficiently. In isolated cases, in tropical climates, and using solar oil fuel, it has not been found necessary to heat the oil at all; the oil at a temperature of about 90 degrees F., giving satisfactory results.

From the above remarks it will be observed that there is a great variation of temperatures and pressures that may give satisfactory results, and the great number of widely different conditions that bear directly and indirectly on the successful burning of oil fuel is such that no "Royal road to success" may be expected. The heating of the fuel enables it to run freely through the pipes, and to burn rapidly owing to its quick vaporising properties under high temperatures. The pressure is governed, or should be governed, by allowing the smallest amount of oil into the furnaces that will maintain the full boiler pressure and prevent the oil dropping and collecting in the furnace bottoms. Any collection of oil in the furnace bottoms must be strictly avoided, for it is a cause of serious danger, and is caused by the combination of temperature and pressure not being correct, or it may be caused by dirty burners.

The temperatures as shown by the thermometers on the boiler fronts must not be taken as the final temperature of the oil as it leaves the burners. The burner end being inside the furnace, and in close proximity to the flame gains considerable heat, which is to a certain extent imparted to the oil before delivery. Black smoke may be caused in a variety of ways; an insufficient quantity of air admitted to the furnaces is a very common cause; too much air being admitted at the bottom of the furnace may cause it. The best place for admitting the air appears to be directly behind the burners. Unsatisfactory pressures and temperatures may be the cause. If forced draught is used, the pressure may be too low, or the pressure may be too high with the fault of having a too contracted air vent area.

Should the boilers develop black smoke after running satisfactorily for some time, and all other factors remain the same, this indicates invariably that the back ends are leaky. In some cases the boiler construction may be a contributory cause, and whilst it would be impossible to enumerate all the causes, the reasons given above are the most prevalent.

White smoke is not nearly so common as the previous fault, and is caused by an excessive amount of air being admitted to the furnaces. This condition should be particularly avoided for the consumption of oil fuel increases rapidly under it.

It should be borne in mind, however, that absolute smokeless combustion need not necessarily mean the most economic-

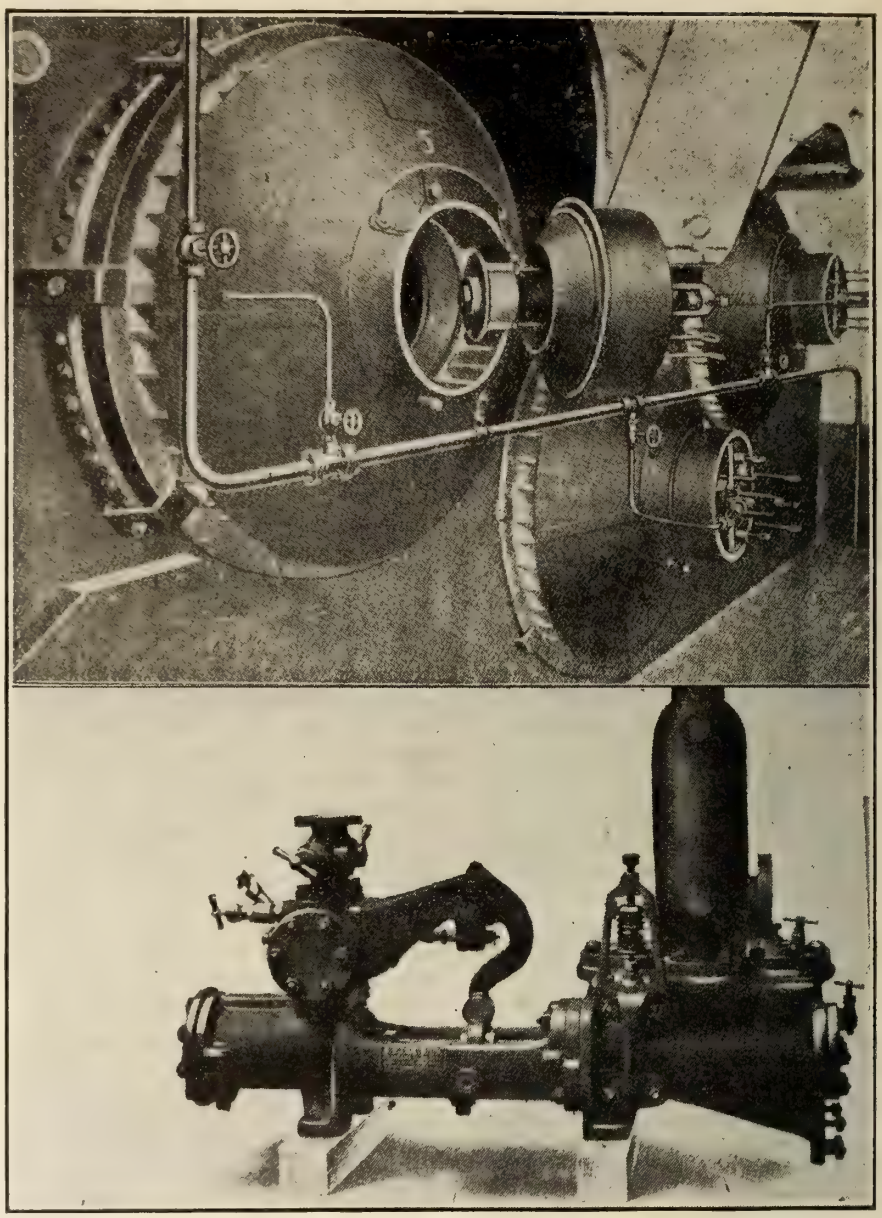
al condition, a slight haze is preferable.

Should boilers pant when under action, it is an indication that there is not a sufficient quantity of air being admitted to the furnaces. When lighting up cold boilers, smokeless combustion must not be expected, but when the boilers get thoroughly warmed up, if the combination of pressures (oil and fan) and temperatures are correct, almost smokeless combustion is the result. After the boilers have been shut off for some little time, there is often an accumulation of gas in the furnaces and combustion chambers, that is of a very explosive nature, therefore before introducing a torch into the furnaces for lighting up purposes, it is imperative that the air vents should be opened first to blow out the gases, also, it is extremely dangerous, under certain conditions, to turn on the oil first and then afterwards apply the torch.

In all cases when lighting up, the actions must be in the following rotation: firstly, air vents to be opened; secondly, introduce the torch; then turn on the oil. More engineers have been badly burnt through the non-observance of this routine than from any other cause, and when one considers that an explosion of the severity of 200 lb. per sq. inch may result from such an action, it is surprising that really severe accidents are so rare. burnt, the funnel damper is invariably

In ships where oil fuel is permanently omitted, whereas the ships that are fitted for quick converting still retain the funnel damper. In such cases it is advisable to lock it in the open position so that it cannot be accidentaly closed, severe explosions similiar to the kind quoted in the last paragraph are sometimes traceable to a shut funnel damper.

With oil fuel, the workmanship of the boilers and fittings should be of the best, and all air that is present in the funnel should have entered by the furnaces, particular care should be taken with the smoke-boxes and base of the funnel to make them as airtight as possible. The exclusion of air from the smoke-boxes and funnel base is of far more importance than the average engineer seems to realize. With forced draught the same applies and it is of the utmost importance that the forced draught tubes and casings in the base of the funnel should be tested periodically and maintained in a perfectly airtight condition. Should air leak into the smoke-boxes it will combine with any unconsumed gases that may be present, and, if the gases are at a sufficiently high temperature, spontaneous combustion is the result, and the air casings and tubes, top of the smoke-box doors, and the base of the funnel assume a red heat. In many cases the air tubes are burnt out and the tube plate badly buckled. When using oil fuel the slow fouling of the boiler tubes is a noticeable feature. If, however, the boiler tubes foul rapidly and require sweeping at short intervals, it is an indication that air is finding its way into the smoke-boxes, and a thorough examination should be made to locate the faults.



Top—Natural draught stokehold arrangement. Bottom—Oil pressure pump.

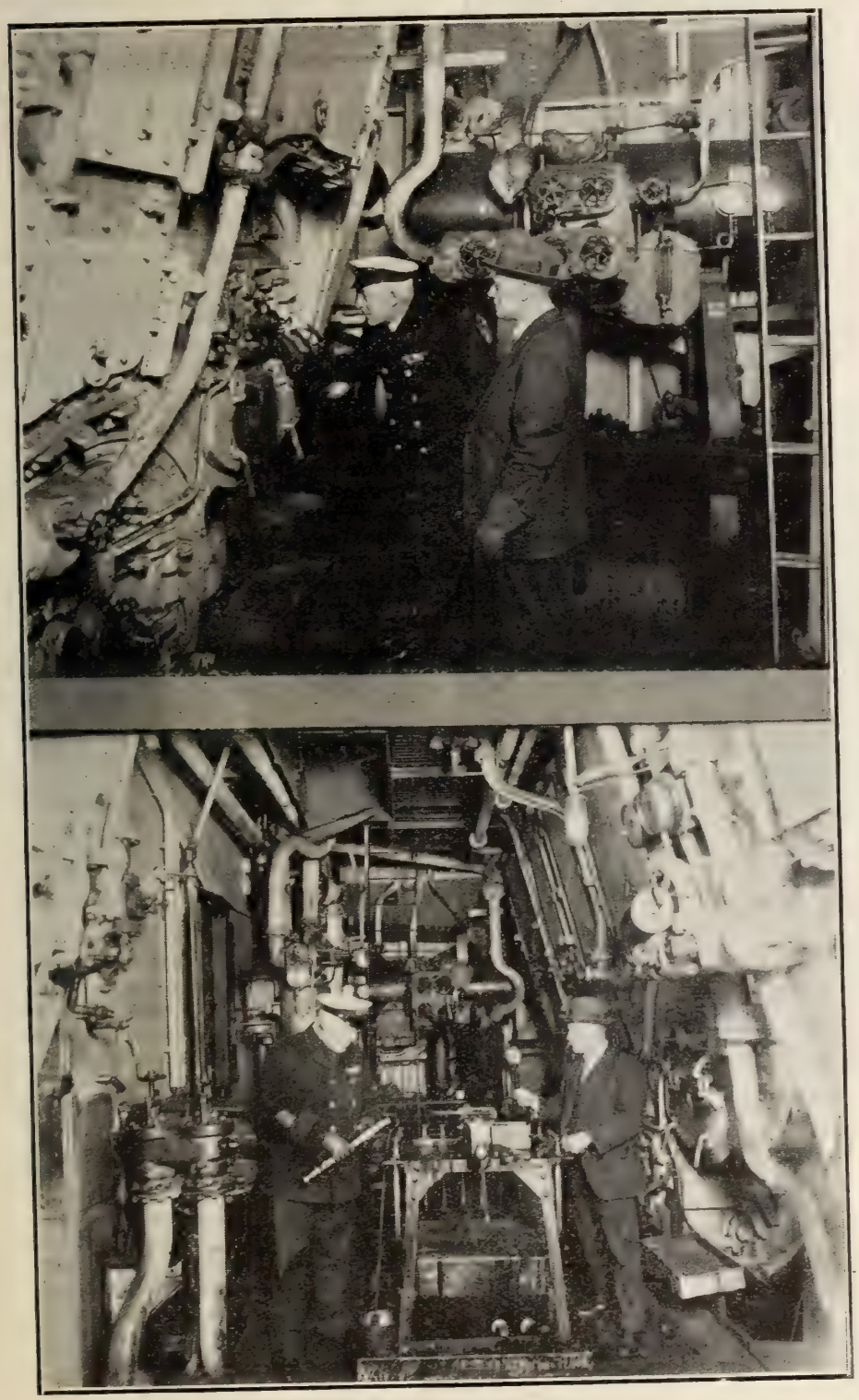
A case is on record where it was necessary to sweep tubes every 24 hours owing to excessive air leaks into the smoke-boxes. Never in any circumstances neglect to clean burners that are spraying badly. If left even for a short time the entire burner may become so badly carbonized as to be ruined. Badly spraying burners are also a fruitful cause of fires owing to the oil collecting in the furnace bottoms and running down the boiler fronts. Cleanliness in the stokehold is a virtue, and special attention must be paid to the cleanliness of the platforms and tank tops, and no leaks, however slight, must be permitted. In the interests of safety there should be two large and several small chemical fire extinguishers fitted so as to be ready in case of accidents. As a rule the reserve power held by boilers on oil fuel over and above the normal demands is fairly great, when boilers are called upon to exceed their normal output to any great extent a certain amount of caution must be exercised to save them from heavy depreciation in value. To illustrate my meaning: A ship of easy steaming power, and possessing three boilers, had the misfortune to have to shut down two boilers owing to defects. The remaining boiler was worked to its utmost capacity and the ship made exceptionally good progress for nearly two days. Upon arriving at their destination it was found that a number of stay nuts had been completely burned off, owing to the excessive amount of work that the boiler had been called upon to do. Whilst not advocating the use, or misuse, of oil fuel in this direction to such an extent the case is brought forward to show the reserve power held by a boiler on oil fuel provided it is properly fitted.

When at any time it is necessary to shut off the oil from the boilers, special care should be taken to prevent any

Continued on page 14

Oil Burning Installation on "Empress of Britain"

The Canadian Pacific Steamships, Limited, steamer "Empress of Britain," was some months ago converted from a coal burner to an oil burner. This steamer is one of the crack steamers of this company's North Atlantic Fleet. She is a twin screw steamer, having quadruple expansion reciprocating engines indicating 19,000 h.p. There are nine boilers with sixty furnaces, which are now fitted with oil burners of the dual type. After several months' successful operation the following matters are worthy of interest. Less space is required for bunker room which in the "Empress of Britain" figures out about 36 cubic feet per ton of oil to 44 cubic feet per ton of coal. When it is also taken into consideration that greater heat per pound can be extracted from the oil fuel the saving in space becomes relatively greater. There are 20,000 B. T. U. in a pound of oil and only 14,500 B. T. U. in a pound of coal. However, this factor of the greater number of heat units in oil is of greater importance than one would consider at a first glance, because more complete combustion can be obtained in the case of oil and thus adding to the oil another point in its favor.



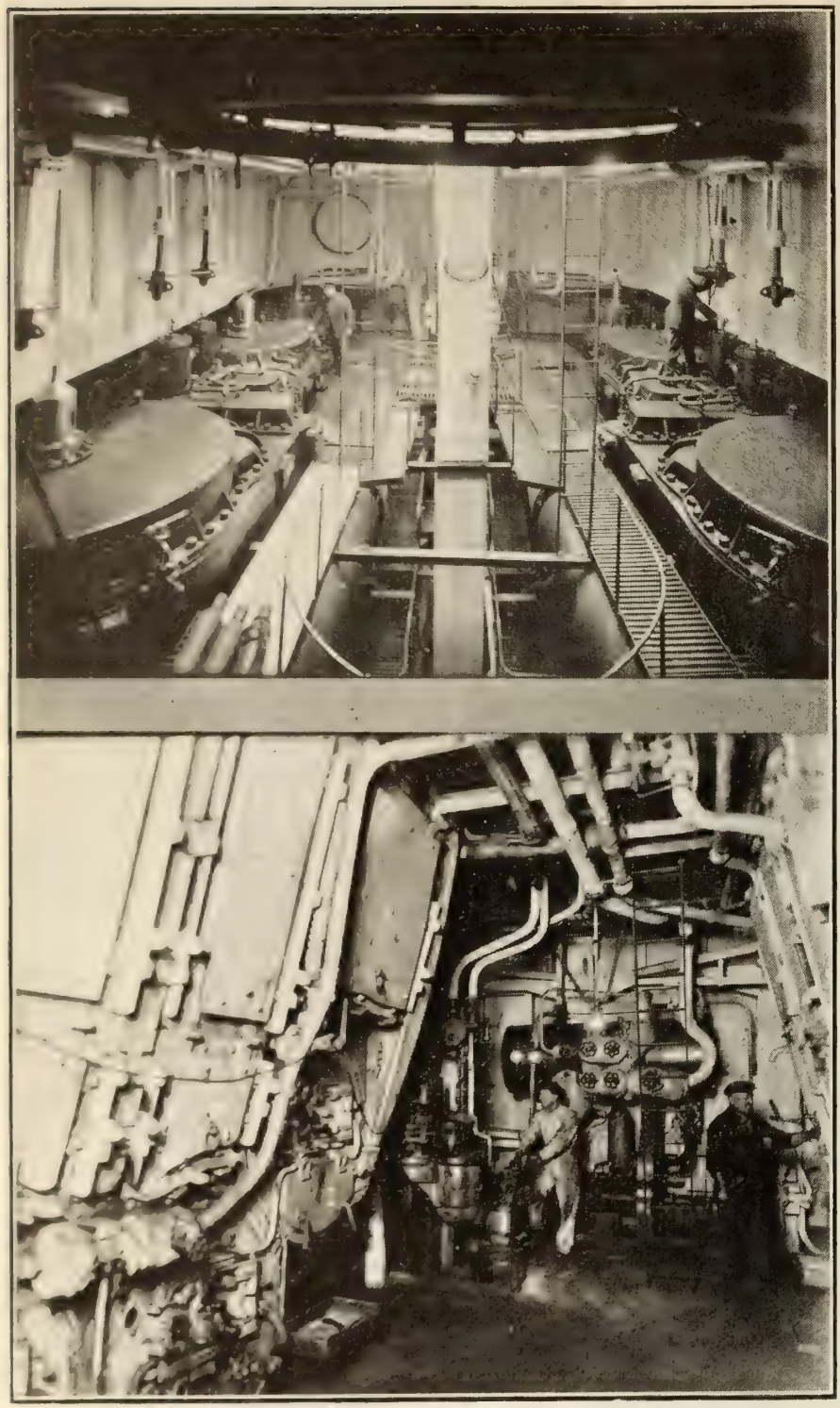
Top—Admiral G. W. Roome and Chief Engineer A. E. Philip examining flame in furnace.
Below—Examining burner.

Further the number of stokers can be reduced by two-thirds, and still a greater control of the fires can be obtained. It has also been found that the temperature of the stoke hold is reduced from 15 degrees to 20 degrees Fahrenheit.

An additional economy is in that of the space required by the boilers themselves. As the fires do not have to be worked, the boilers can be set closer together.

Another marked advantage of oil over coal is the cleanliness of the former, not only in bunkering but in actual stoking or working conditions. When one considers the amount of labor involved in keeping clean a ship the size of the "Empress of Britain" with all her fine appointments, the economy from this point alone becomes evident, and is a big factor.

The general method of operation of an oil burning steamer is to have the oil pumped into the tanks that act as bunkers. Then the oil is pumped into the direct supply tanks known as the settling tanks. These latter tanks are usually placed at some distance above the floor plates, and are intended to allow any water which may have become mixed with the oil, to settle to the bottom, leaving the pure oil at the top of the tank. This oil is then filtered cold and then heated and filtered a second time when hot, it is forced through the filters by pumps. The oil is at about 200 degrees F. when filtered hot. The oil pressure is then raised to a point from 110 pounds to 170 pounds, the pressure varying according to the pressure and amount of steam required for operating conditions. The temperature of the oil is a very vital point, for the successful operation of the fuel, and it must be maintained at all costs. The oil is then pumped under pressure direct to the burners and is sprayed into the furnaces through the needle valves in the burner, which are located in the front of the furnaces. The oil is thoroughly atomized after leaving the needle valves and flashes up just after leaving the nozzle. The effect produced being that of a mass of white heat filling the entire



Top—The top platform. Below—No. 3 stokehold.

furnace. Howden's system of forced draft is used in the furnaces but only about the air pressure is required for oil as compared with coal.

Taking all factors into consideration one ton of oil is equivalent to 1.6 tons of coal. The danger from fire is reduced to a minimum. Fire extinguishers and sand boxes are fitted throughout, also fitted to each burner.

The "Empress of Britain" maintains an average speed of 18.56 knots per hour on her trips across the Atlantic, which is somewhat better than she could do with coal fuel. On her first voyage as an oil burner she consumed 1,453 tons of oil fuel as compared with an average of 1,800 tons of coal. Her boiler pressure of 220 pounds was not only steadily but easily maintained. With coal as fuel the Empress used to carry 120 stokers and trimmers and with oil she now only carries 27. This gives additional extra room for the accommodation of more passengers as it is a considerable saving of space occupied by the crew.

There is little or no smoke from the funnels of the Empress as an oil burner.

The only factor that might be considered a serious one to the use of oil on all ships on regular routes, is the economic supply of oil in sufficient quantities.

BURNING OIL FUEL

(Continued from page 12)

air from finding a way into the furnaces and combustion chambers, and all sudden changes of temperature should be avoided. Too much exertion cannot be used in the closing of dampers and air ducts, etc., after shutting off the oil fuel, neglect and sluggish action in this particular soon makes itself apparent in the shape of leaky seams, rivets and tubes. Always keep a close watch on the sight feed tank, or the observation tank as it is usually termed, for evidence of oil leaks in the heating system and coils. A leaky system not only means that the oil may be finding its way into the boilers, but also that the water is finding its way into the oil. When using thick fuel oil it is advisable, after shutting off the fires and heaters, to keep the oil pumps running for some time in order to circulate the oil round and round the system until it assumes a normal temperature. Should the pumps be stopped at once, and the oil left hot and stagnant in the pipes and heaters it deposits a pitch-like substance on the interior surfaces when cooling down and the entire system is in danger of becoming choked.

Should the pressure of steam fall, and everything else remains normal, it is not wise to force up the steam pressure by increasing the oil pressure; search for a cause, in all probability it will be found that some of the burners are partly choked and require attention. Forcing up the oil pressures increases the combustion chamber temperatures above normal for a particular pressure of steam. In all cases the oil pressures must be kept as low as possible consistent with satisfactory combustion, and when lighting up cold boilers, careful air regulation is necessary, with forced draught one inch on the hydrostatic gauge is quite plenty.

When burning oil fuel, it is advisable to let the oil flare as near to the burner end as possible, without unduly heating the furnace fronts, this ensures a comparatively even temperature throughout the entire length of the furnace, and reduces combustion chamber temperatures. Within reason, it is advisable to confine combustion to the furnaces as far as possible; with this idea in view it is in certain cases, advisable to increase the forced draught air vent area, this allows a certain amount of latitude for experimenting purposes. By increasing the vent area it is possible to supply the same amount of air, or perhaps more at a reduced pressure. For the jointing of all oil pipes, ordinary cardboard is usually used, this has been found from experience to give a reliable joint at a minimum cost.

A German On German Shipping

TO THE latest edition of the "Year-Book" of the Norddeutscher Lloyd, Herr Phillip Heineken, the president of the company, contributes a lengthy preface in which he discusses the present situation of German overseas shipping in relation to existing economic and political conditions. Coming from such a high authority, his observations regarding the present crisis in the shipping trade, the effect of the delivery of German ships to the Entente, the rebuilding of Germany's shipping services, and the future prospects of that country's overseas shipping, are well worthy of close attention. Herr Heinken writes:

The general stagnation in the world's trade must naturally exercise an immediate influence on world shipping. Yet while the traffic in commodities is reduced to a minimum, the commercial tonnage of the world has increased out of all proportion to existing needs. In spite of the war losses the world's cargo tonnage has increased by more than 10,000,000 tons as compared with that of 1914, that is to say, by much more than might have been expected in normal times. This surprising fact is to be attributed to the record production of world shipbuilding, which was stimulated in the first place by necessity and later on by the high prices that prevailed. The North American shipyards, most of which sprang up during the war, have done astonishing things and in the years 1917-1920 they delivered no less than 10,583,334 tons of new ships, although the serviceability and durability of the vessels was not always satisfactory. Japan has also increased her production.

England, on the other hand, in spite of the lead held by her shipbuilding industry, was unable to reach her pre-war production of 1,932,000 tons (in 1913) until the year 1919, and it was only last year that English shipbuilding exceeded the production of the North American yards. This fact alone throws a significant light on the difficulties of the English war economy. In addition to this new tonnage there is the increase in the commercial fleets of these countries, already surfeited with tonnage, by the stolen German mercantile marine. Out of the shipping captured and seized during the war and handed over under the terms of the Versailles Treaty, England alone received about two million tons. The super-abundance of world tonnage at a time of absolute depression in world trade has naturally led to a shipping crisis which, in its suddenness and extent, was both unexpected and hitherto unprecedented. Freight rates in general, it is true, have not again reached their peace level, but they must be judged by the heavy working expenses, which are very much higher than the peace costs, and it is only slowly that an adaptation of their expenses to the changed conditions can be expected to take place. However, a first, though very feeble step towards an improvement has been made with the reduction of the world's market price for bunker coal. Nevertheless a real improvement in the shipping crisis cannot be expected within a measurable time, as it is only a part of the general world crisis, with its far-reaching disturbance of all economic conditions as a result of the war.

Unless the world economy is built up again through the restoration of its natural circulation, and especially through the re-inclusion of Germany with the consent of her enemies, the depression of the shipping market will last a long time yet. It is in the condition already described that the difficult task of rebuilding German overseas shipping has to be undertaken. This rebuilding must include not only the re-creation of the commercial fleet, but also the restoration of the old business connections and the world-embracing trade organization. It was impossible, however to think of anything in the way of an unhindered reconstruction so long as the claims of the German shipowners for compensation from the Reich were still in doubt. The long prevailing uncertainty as to the amount of compensation that would be received had a particularly detrimental effect, and it was only at the beginning of 1921 that a compromise agreement was reached, and the amount of twelve milliards of marks was fixed. This sum is not nearly enough to cover the actual damage suffered by the shipowning community, but it was accepted in consideration of the other heavy engagements of the German people, as it created a firm basis upon which the owners could proceed to the rebuilding of their fleets to the legally prescribed extent.

If the uncertainty over the financial conditions had such a paralysing effect on the building of new ships in the country, it was still more the case so far as concerned the building or purchase of ships abroad, and in addition to the extraordinarily high prices of ships there was also the unfavorable situation of German currency. For the same reason it was only seldom that recourse could be had to the chartering of foreign ships. After the collapse of the prices of ships in connection with the world shipping crisis, the purchase and chartering of vessels abroad again returned to the realm of possibility, in spite of the exchange difficulties. One is not yet able to foresee, however, to what extent this possibility can be utilised. According to the compensation agreement only 50 per cent of the total amount can be used for the acquisition of foreign ships.

The difficulties which stand in the way of the restoration of overseas relations are tremendous. Of particular influence in this connection are the prohibitions for Germans to reside in former enemy countries and the restrictions placed upon them, and the inability of Germans formerly residing abroad to return to their second homes until their claims for compensation have been satisfied. Thus invaluable factors for German world trade are kept idle which, with their knowledge of foreign conditions and their great influence in the establishment of reasonable or friendly relations with other peoples, could render an incalculable service to German foreign trade.

The great business organizations of the various shipping companies must be very considerably reduced, unless, as in the case of the German-American shipping agreements, they are made useful in the service of foreign companies. Thus German shipping, especially abroad, loses a vast amount of valuable experience and numerous old connections which it will take a very long time to win back. The present limited export trade of Germany would suffice to give our small merchant fleet employment, but it is faced by the strong competition of foreign shipping companies which attract a portion of the cargoes to themselves or exclusively dominate such routes as are not yet being again used by German ships.

In the circumstances that have been described, it has so far been impossible to speak of a restoration, to any noteworthy extent, of German ocean shipping. Nevertheless, one can look back with satisfaction on what has been achieved. Germany is again joining in the world traffic, and that means much, even though it is mostly foreign ships that carry the trade. But the German shipping companies are gradually resuming their old connections. To North and South America, to Africa and India, German ships again carry the old black-white-red flag.

The newly striving German shipping was naturally affected by the general shipping crisis, but not to the same extent as foreign shipping. The boom in the shipping business has caused foreign companies to make purchases or conclude contracts for new ships at boom prices, and it was also the reason for the increase of working expenses, and more particularly for the higher wages of the crews. The sharp decline of freight rates was somewhat mitigated for the German shipowners through the money exchange conditions, but in their case also the rates have nearly reached the border line between profit and loss.

It is difficult to make any sort of prediction as to the future prospects of German shipping. But one thing is clearly established: The German shipowners desire the rebuilding of ocean shipping, and have already made a beginning, confident in the value of their rich experience and their proved strength. The valuable peace efforts of our shipping were only an expression of the mental and moral powers dormant in the German people, their scientific proficiency, their inventive capacity, and gift for organization, their diligence and conscientiousness. These are qualities which no enemy can steal or make serviceable to himself in slave labor.

GRAIN shipments out of Vancouver will be so heavy during the next few months that the management of the Johnson Steamship Line will be unable to handle a contract for the carrying of lumber to the Soudan, according to advices just received here. This is just one of many indications of the recent growth in sea-borne trade out of British Columbia ports and demonstrates the importance of the grain movement, which is steadily assuming larger proportions.

* * *

Export trade in lumber has also been stimulated to a pronounced extent, resulting in increased business for shipping. The Associated Timber Exporters of British Columbia have booked orders within the last few days for 26,000,000 feet of lumber at a base price of $16 a thousand, and have oversold. The British Admiralty has purchased 2,500,000 feet of timbers and planks for dockyard construction in Great Britain. India is in the market for 40,000,000 feet of cresoted and 5,000,000 feet of ties not creosoted, and probably will buy heavily in British Columbia. China and Japan are buying steadily, particularly Japan, which is now having cedar logs shipped by deckload. Australia is taking lumber in parcel lots on regular steamships. South America and South Africa are making inquiries. All this means business for cargo-carriers. The Canadian Government Mercantile Marine is getting a large share of the trade which is offering.

* * *

The cause of the disability of the steamship Canadian Importer, now being repaired in Vancouver by the British Columbia Marine Engineers and Drydock Company, is still unknown, but the theory entertained by those who have made an investigation is that one of the sea-cocks was accidentally opened. There is another theory to the effect that a hole in the pipes leading to the bathrooms was responsible, but this has been discounted. The cost of the repairs will be approximately $12,000.

* * *

The American-Hawaiian liner Arizonan, being operated by the United American (Harriman) Lines ran aground at Rocks Point, San Juan Island, and sustained serious damage amidships a few days ago. She is now at Esquimalt awaiting survey, and the Federal Department of Public Works is being urged to reduce the drydock fees in this particular case in order that British Columbia firms can tender on the job on a competitive basis with American yards which own their own drydocks, and can fix a nominal charge. The Federal Drydock charges have been increased about 240 per cent since 1919, and for a ship of the Arizonan's size the cost for drydocking alone is $800 a day.

* * *

Taken over by Dant & Russell, of Portland, Ore., on a time charter for one year, the first three carriers built by the famous Skinner & Eddy yard in Seattle — the Norwegian steamships Niels Nielson, Hama Nielson and Luise Nielson—may return to the Pacific trade after a lengthy absence. They probably will be used in the transport of lumber and other products to the Orient to return with general cargo. All three vessels are now in Cardiff, Wales.

* * *

Effective with the sailing of the Japanese line Suwa Maru, from Yokohama for Victoria, November 11, the Nippon Yusen Kaisha, Japan's premier shipping line, will introduce a reduced scale of passenger rates for the trans-Atlantic service. The amount of the cut amounts to roughly ten per cent. Single promenade cabins will be reduced from $375 to $345. Upper deck double cabins will drop from $300 to $270. Dealing with the proposed cut, the Japan Advertiser says:

"While many hold the opinion that the N.Y.K. reduction is the forerunner of a general passenger rate cut in which all the companies running ships between the Orient and America will participate, no such effect is probable, immediately at least, it is said. The N.Y.K. is not a member of the passenger conference, nor has it been adhering to the rates agreed upon by the conference which the other shipping companies have been quoting for passage on first class vessels. The N.Y.K. rates, despite the reduction, thus remain higher than the agreed price except in the case of the double cabins on the upper deck.

"The Pacific Mail, Toyo Kisen Kaisha and the C.P.O.S., Ltd., are the only firms in the conference, but the Admiral Line and China Mail are technical members because in the past they have adopted the standard passenger rates. This rate is $300 gold, or the equivalent in yen, according to the current exchange rates for all ordinary cabins. Special accommodations are sold at varying rates according to the varying degrees of comfort offered on the various ships. Thus the N.Y.K. has merely reduced its price for accommodations, about ten per cent."

Petition for the rehearing of the original petition of the Canadian Pacific Railway for limitation of liability as a result of the sinking of the steamship Princess Sophia in Lynn Canal, Alaska, in October, 1918, was filed in the Federal Court at Seattle recently. There were 349 victims of the Sophia disaster. Claims aggregating $2,500,000 are now on file in the case, representing the claims of relatives of 250 persons who went down with the ship. Total claims will aggregate $1,000,000 more, it is estimated. The C.P.R. seeks to limit the claims to about $8,000, representing the passenger fares and freight charges for the trip.

* * *

President Ito, of the Nippon Yusen Kaisha, is planning to visit Victoria and other Pacific coast ports, according to advices received by W. R. Dale, local agent for the shipping company. Recent changes have been made in the sailing schedules of the N.Y.K. boats, which have resulted in cutting down the eastward Pacific passage from nineteen to sixteen days.

* * *

The steamer Princess May, formerly operated by the Canadian Pacific out of Victoria, is reported ashore on the northeast coast of Cuba. The vessel was sold about four years ago to the Di Georgio Company, of New York, to engage in the fruit trade.

* * *

The American Association of Port Authorities held their annual convention in Seattle this month, and many of the delegates visited Victoria and Vancouver, where the Pacific Coast Association of Port Authorities held their convention. The purpose of the associations is to exchange information relative to construction, maintenance, operation, organization, financing and management, and to formulate recommendations regrading these various matters; also to encourage water-borne transportation and industrial development and to promote city, state and national publicity of all port affairs.

* * *

It is reported that if the Wallace Shipyards secure the twenty-five year lease they seek for the government drydock now at Prince Rupert, the equipment and plant may be towed to Vancouver and retained there. It is estimated that Vancouver is losing $60,000 annually through lack of adequate drydock facilities.

Speculation is rife as to the success or failure of the salvage operations commenced on the hulk of the steamship Canadian Exporter, stranded in Shoalwater Bay, near Willapa Harbor, Wash. Five hundred thousand feet of lumber has been rescued, as well as the more valuable fittings. Dynamite may be used to get out the inaccessible timbers. The wreck was purchased for $2,000 by H, R. MacMillan, of the MacMillan Export Company, and Percy Sills, Vancouver lumberman.

* * *

The Lady Kindersley, the trading steamer especially built for Arctic navigation, by the B. C. Marine Engineers Company, Vancouver, now on her first cruise into northern waters, narrowly averted disaster recently when she was pounded by the surf in shoals between Cape Prince of Wales and Schismareff Inlet. She withstood the buffeting successfully, although the engines were badly damaged and one propeller was lost.

* * *

W. Fitzherbert Bullen, founder of the British Marine Ways, which sold out to Yarrows, Ltd., the British shipbuilding concern when it established itself at Esquimalt about eight years ago, died in Victoria, October 2. He was 64 years old. For years he was one of the leaders in the shipbuilding and repair industry on the North Pacific.

* * *

It is understood that the negotiations between J. J. Coughlan, Clarence Wallace and the Dominion Government regarding a subsidy for a drydock on Burrard Inlet, have been concluded, and the Burrard Drydock Company, Ltd., has been incorporated. The cost of the project is estimated at $2,500,000. Messrs. Coughlan and Wallace, both Vancouver shipbuilders, have been in Ottawa for several days.

* * *

The Pacific Cable Board proposes to duplicate the present cable connecting Australia with Canada, according to Sir Timothy Coghlan, agent-general for New South Wales in London, who recently passed through Victoria. Volume of business has necessitated increasing the cable facilities, and with two cables in operation there will be no danger of interruption in transmission due to accidents.

* * *

The Canadian Government Mercantile Marine, Ltd., has now definitely taken over the wooden barquentines built by the Cholberg Shipyards, Victoria, for the Victoria shipowners, Ltd. The absorption of the fleet by the government was a result of the financial tangle in which the ship company found itself. cost of construction being about $20,000 more per ship than was anticipated. The ships will be operated in the lumber trade. Only one of the vessels has been completed, the S. F. Tolmie, which is now on berth for Australia. The other two vessels are still on the stocks and will probably be finished this winter.

The Dominion Government patrol steamer Givency, which has been under water since September 3, at Chatfield Island, has been floated and will be towed into Esquimalt for repairs.

* * *

Demand for lumber in Japan has been responsible for a big increase this year in shipments to the Far East from Vancouver Island saw mills. This development has brought business to the Canadian government steamships plying in the Oriental service, and also to private operators. A house-building boom has been in progress in Japan and Japanese lumber has been so high that Canadian and American stock, lower now than it has been in many years, has been imported in large volume. All available space on steamships plying between here and Japan during the next two months has been reserved for lumber shipments and the movement has been steady since early in the spring.

* * *

By next summer the Canadian Pacific Steamships, Ltd., will have the palatial new liners, Empress of China and Empress of Canada, plying in the regular trans-Pacific services between Victoria, Vancouver and the Far East, according to William Webber, general agent at Atlantic ports for the Canadian Pacific Railway, (ocean traffic), who was here recently. "Two months ago it would have been difficult to say when these vessels would be in service," said Mr. Webber. "Trouble with the joiners on the Clyde is now over, and we look for delivery early next summer.

* * *

The Canadian Pacific coast service will shortly be able to supplement its service to northern British Columbia ports as a result of the completion of the steamship Princess Louise, at the Wallace Shipyards, North Vancouver. While the official trials will be held in a few weeks, it is probable that the new steamer will not be sent north until early next spring, according to Captain J. W. Troup, manager of the service. Some of the elaborate furnishings removed from the C.P.R. steamship Princess Margaret when she was taken over by the British Admiralty during the war, are being installed on the Louise.

* * *

Recent advises from Australia indicate that serious defects have been discovered in the construction of the "E" class steamers of the Commonwealth, (Government) Line, a number of which have been fitted with expensive refrigerating plants, which, on being tested, have been found to be practically useless. It is stated that in many cases the material used in construction proved unsuitable and that insulation has been so bad that air has reached the freezing chambers through apertures in the roof and sides owing to faulty joinery.

News from Port of Sorel

WORK at the salvage of the Canadian Recruit is going on satisfactorily. This boat sank at about fifty miles below Quebec and tanks made at Sorel have been taken down and chained to her sides. Now the men are waiting for favorable weather to do the raising. Strong winds we have had lately have prevented doing this job before.

* * *

The Duchess of York, owned by Mr. Normand of Montreal, is now at Sorel for the winter. Mr. Normand has had an interview with the Sorel Mechanical Shops in connection with general alterations to the boat. Larger room for the saloons will be provided. This steamer does the ferry transportation between Montreal and St. Helen Island.

* * *

Mr. A. E. Hopper, Principal Inspector, of the Board of Steamship Inspection, Ottawa, was in Sorel, this week, visiting Steamship Inspector, also in connection with general repairs being made to the Lady Grey and the Montcalm, both icebreakers, which will have to be ready for service between the 15th and the 20th of November.

* * *

Barge No. 4 of the St. Lawrence Channel Fleet of the Government, is on the ways at the Government Shipyard, Sorel, undergoing repairs which will put her back to the condition she was in when loaned to the Naval Service Department for use at Halifax and vicinity during the war.

* * *

Mayor W. G. M. Morgan, is having his wharf on the Richelieu River repaired. For quite some time there were obstructions at the foot of the wharf, and these will be removed. Hereafter the wharf will be one of the best along these shores.

* * *

Mr. F. X. Hamelin, Steamship Inspector of Sorel District, was called upon to attend the trial trip of the Canadian Challenger which took place betweeen Three Rivers and Quebec. It is interesting for Sorel people to hear about the work done on this vessel, as most of the mechanics and boilermakers employed at the construction of this vessel came from Sorel. Their foreman is Mr. Duncan Wilkie. The hull was built at Levis by the Davie Company. She has a tonnage of about 8000 tons, with triple expansion engines, H. P. 27, I P 44, L P 73, 48" stroke and fitted with three 15 feet diam, boilers at 180 lbs. pressure, heating system being fuel oil system.

The boat is now at Levis and will leave there Friday, 21st inst., for Montreal, where it is rumored she will be loaded for Russia.

A Guide to the Canadian Marine Certificate

In this Article the Reader is Introduced to the Fundamental Rules Governing Boiler Design, and the Relation Between Circumferential and Longitudinal Seams is Shown. A Single Riveted Joint Is Discussed

By T. H. FENNER.

HAVING gone over the preliminary arithmetical calculations with which the marine engineer must be familiar, we can now go on to the actual calculations necessary, in obtaining the certificates. In following these out, we shall see just what the formulae mean, and how they are derived as far as possible. In taking them up we shall first deal with those relating to the boiler, as they are the most in use.

Pressure On a Sphere

Before going on with actual boiler calculations, we shall consider why the boiler is made in the particular shape that it is, instead of a rectangular style. The strongest known form to make a vessel to resist internal pressure would be a sphere, but it is obviously impossible to make a boiler of that shape. However, we can see that next to a sphere a cylindrical form is the next best, and that is the form adopted in practically all types of marine boilers.

Suppose that we had a sphere containing internal pressure. This pressure would act equally on every portion of the shell of the sphere, the pressure on the total surface being equal to the pressure per square inch multiplied by the surface exposed. Now, if we imagine this pressure applied to a diametrical plane of breadth b, and diameter d, we can assume that the total pressure acting on that plane will be the pressure per square inch, called p, multiplied by d, and by b, or

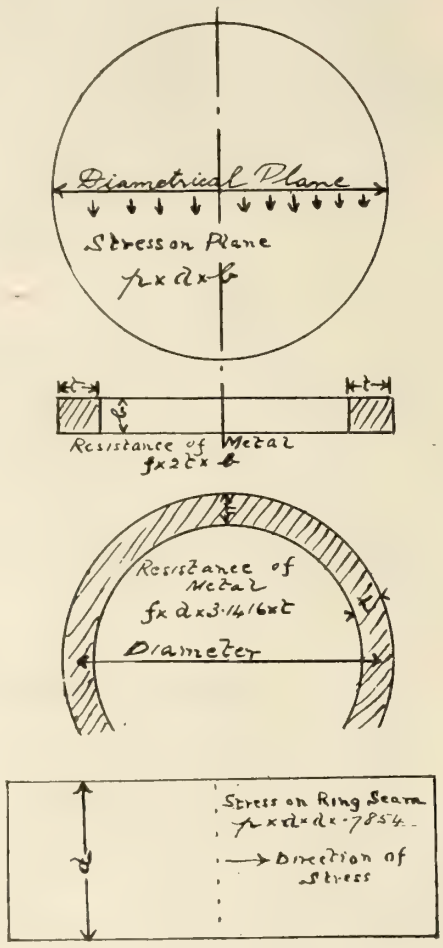
$$pxdxb. = \text{Total Load.}$$

This pressure or load will induce a stress in the metal comprising the sphere and this stress must be exactly equal to the load due to the internal pressure, in order that the sphere remains in equilibrium, or in other words, in order that the sphere will not burst. If we call this stress f lbs. per square inch, then the total stress in the metal will be due to the stress per square inch, multiplied by the area of the metal resisting the internal pressure. This metal will be the thickness of the shell on each side of the sphere, multiplied by the breadth of the diametrical plane taken, b, or in formula

$$fx2txb = \text{Stress in Metal.}$$

This 2t is taken because it is the thickness of the metal on each side which must be considered. Now if these two stresses must be equal, that is the stress in the metal must be equal to the load due to internal pressure, we have

$$pxdxb = fx2txb$$



Showing stresses on longitudinal and circumferential seams.

We wish to find what this stress f really is, so we work out the equation as follows:

$$fx2txb = pxdxb$$

$$f = \frac{pxdxb}{2t \text{ x } b}$$

$$f = \frac{pxd}{2t}$$

That is, the stress f is equal to the product of the pressure multiplied by the diameter, and divided by twice the thickness of the plate. Suppose we have a sphere of 60 inches diameter, made of plate ½ inch thick and that the breaking strength of the metal is 60,000 lbs. per square inch. Then if we wish to find the pressure that it would take to burst the sphere, we take these figures and introduce them in the formula. We have the known quantities, f is 60,000, 2t. is 1, and diameter is 60. Then in order to find p we have

$$p = \frac{f \text{ x } 2t}{d}$$

$$p = \frac{60{,}000 \text{ x } 1}{60}$$

$$p = 1000$$

that is it would take a pressure of 1,000 lbs. per square inch to burst the sphere. This shows that the vessel is of very great strength. If we now wish to have a working pressure of 200 lbs. per square inch on the sphere, we shall find how much stress would be induced in the metal. Here we want to find f, so we have

$$f = \frac{p \text{ x } d}{2t}$$

$$f = \frac{200x60}{1}$$

$$f = 12000$$

Thus the stress induced would be only 12,000 lbs. per square inch, or only one-fifth of the breaking strength.

Now a boiler cannot be built as a sphere, but the cylindrical part of the boiler can be considered as a sphere, and is calculated as such. However, in considering the sphere, we have thought of it as a solid ring of metal, without any joints to break its continuous form. In a real boiler we have to make the shell of a number of plates, and to join these plates together with rivets. It is easily to be seen that these plates after joining, cannot be as strong as a cylinder made out of one sheet without a joint. We use a different method of riveting for the joints that run lengthwise, or the longitudinal seams, as they are termed, and the ring or circumferential seams, the latter being much weaker than the former. There is a good reason for this as the stress on the circumferential seams is only half that on the longitudinal seams, as we can show by a little calculation.

We have seen that the stress tending to burst the sphere, or in the boiler, the stress tending to burst the shell at the longitudinal seams, is equal to the pressure x diameter and divided by twice the thickness. Now, if we consider the stress induced on the ring seams by the pressure on the heads we shall see that it is less by one half.

The total pressure, or total load tending to pull the boiler apart at the ring seams, will be due to the pressure per

square inch, acting on the area of the end of the cylinder. That is

p x a

or p x d x d x .7854

and in order to resist this force there will be a ring of metal equal to the circumference of the boiler and of a thickness t. The stress induced in the metal will be

fxdx3.1416xt

and this stress must equal the internal load. That is

frdx3.146xt=pxdxdx.7854

and therefore f will equal

$$f = \frac{pxdxdx.7854}{dxtx3.1416}$$

and $f = \frac{p\,d}{4t}$

which shows that the stress on the ring is only half of that on the longitudinal seams.

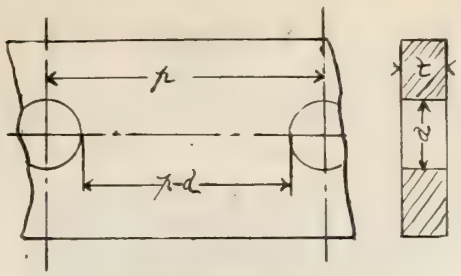
Riveted Joints

We can now proceed to examine the effect of the riveted joints on the strength of the completed shell. As these joints are made in various ways we must consider them all, and first of all we will examine a joint of the most simple character, that is, a seam made with a single row of rivets. In considering these joints we always take a piece of the plate contained between two adjacent rivet holes, and call this the unit section of plate. This unit section will be a plate of a length equal to the pitch, or distance between rivet holes, and a thickness which will be called t. If the stress per square inch which the metal can stand, is 60,000 lbs. per square inch, then the plate will be good for a total stress of

pxtx60000.

Now, if we drill a hole in this plate or several holes, the plate will be weakened thereby, and the amount of metal left will be less than the original. Supposing that we drill one hole, which would be the case in a single riveted joint, we should have only a plate of area equal to only the pitch, minus the diameter, multiplied by the thickness. Now this rivet hole may be in the center of the plate, or two rivet holes would be drilled, half of each of which would be inside the space between the pitch lines. This is the actual case, but of course there is only one hole in the pitch. The total stress which the plate could then stand would be (p—d)xtx60000.

Now, the relation of the strength of the plate after drilling, as compared to the solid original plate, is always expressed as a percentage of the strength of the solid plate, and is obtained by dividing the strength of the solid plate into the strength of the plate after drilling, and multiplying the product by 100. Thus if we take a pitch of, say, 2 inches, with a thickness of plate of 5/16ths inch, and a diameter of rivet hole of 5/8, we can see what the solid



Single Riveted joint.

plate is good for and what the drilled plate, and compare them.

First we have

pxtx60000

2x5/16x60000

which is 37,500 lbs.

That is the strength of the solid plate. Next we have

(p—d)xtx60000

(2—5/8)x5/16x60000

which is 25781.25

Now comparing the two we have 25781.25, divided by 37500 and multiplied by 100, or

25781.25/37500x100=68.75 per cent.

Thus we see that the plate, after being drilled is only 68.75 per cent as strong as the original plate. If this plate was part of the boiler shell, the shell would only be, in plate strength, 68.75 per cent as strong as a shell without any riveted joint.

This calculation is always used in the form of a formula, in which P is the pitch of rivets, D the diameter of rivets, and is stated as follows:

$$\frac{P-D}{P} \times 100 = \text{Percentage of strength}$$

of plate to solid plate.

The Rivet Area

We have another factor to take into account, and that is the strength of the joint considered on the area of the rivets which are put in the holes. This will depend on the sectional area of all the rivets contained in the pitch, or unit piece of plate, and on the stress per square inch allowable on these rivets. Now while the stress on the plates is a tensile stress, or a stress tending to pull the plate out longer than its original length, the stress on the rivets is a shearing stress, or a stress that tends to shear the metal across, as a piece of plate is sheared by a shearing machine. The resistance of the metal to shearing is less than to tension, and for this reason a lower stress per square inch is allowed on the rivet in shear. This is usually about 48,000 lbs., but is very often expressed as a fraction of the tensile stress of the plate. Thus if the tensile stress of the plate is 60,000 and the shearing stress of the rivet is 48,000 lbs., the rivet strength will be multiplied by a fraction 4/5, or .3. The British Board of Trade rules usually express this as a fraction 23/28, this being the stress expressed in tons per square inch, instead of pounds.

Now we have in a single riveted joint only one rivet per unit length or pitch, and its area will be diameter squared multiplied by .7854, and the stress it will carry will be this area multiplied by the allowable stress per square inch on the metal. This stress divided by the stress that the unit section of the plate will carry, and multiplied by 100, is the percentage of strength of the rivets to the solid plate. The stress in shear on the rivet may be assumed to be 48,000 lbs. then the stress will be

a x n x 48,000

where a is the area and n the number of rivets in a pitch. Putting in figures we have

5/8 x 5/8 x .7854 x 1 x 48,000

which gives us 14,400, and this divided by the stress on the unit plate is 14400/37500 x 100 or 38.4 per cent. This is much lower than the plate strength and much lower than it should be, but this is due to the proportions we have adopted. We can see later how to correct this. What we want to see at present is how the formulae for the strength of a riveted joint are arrived at. The formula for the rivet section strength is as follows

$$\frac{a \times n \times c}{p \times t} \times 100 =$$

percentage of strength of rivet section to solid plate.

Where a is the area of the rivet, n is the number of rivets in a pitch, c is a constant found by dividing the shearing strength of the rivet by the tensile strength of the plate, p is the pitch of rivets, and t the thickness of plate. We have thus got the two formulae that are used for determining the strength of riveted joints and can now proceed a bit further with our calculations. First let us work out the formula for rivet strength, placing the figures in the place of letters.

$$\frac{.3x1x.8x100}{2x.3125} = 38.4 \text{ per cent.}$$

which is the same result as we obtained before.

The efficiency of a joint with a single riveted seam should be in the neighborhood of 50 per cent., while we see that the percentage in this joint is for the plate 68.75, and for the rivets 38.4. This is not at all in proportion, and we shall take up in our next lesson the method of determining the sizes required to give a joint of approximately the right strength.

Newcastle-on-Tyne:—The new Cunard liner "Berengeria" formerly the German steamer "Imperator" will be converted from coal to oil fuel by Armstrong Whitworth, at their yard here. The "Berengeria" is the world's third largest ship, her dimensions being 882 feet long, by 98 feet beam, and 57 feet depth, her displacement being 57,000 tons. The work of re-conditioning will probably take about six months.

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Ships as Exhibitions

BOTH IN the United States and Great Britain ships are being fitted out to act as floating exhibitions, and carry their exhibits over the seas to all the ports of the world. The idea is a good one, and judging by the interest displayed in the French train that visited this country during the summer, should do a vast amount of good for the industries represented in the exhibits. Naturally, a ship affords a much more advantageous setting for an exhibition than a train, the space being much greater, and the possibilities of ingress and egress much better than on a train. That was one of the unfortunate features of the French exhibition, spectators having to line up at the end of the coach, and pass through in some cases much more quickly than they would have liked. In a large passenger vessel, with the ample companionways and decks, people will be able to linger as long as they wish over any particular exhibit without inconveniencing others by holding them back. It is the intention of the promoters of each of these exhibition ships to allow them ample time in each port, and the duration of the voyage will probably be about one year.

It is somewhat amusing to read the announcement issued by the publicity department of the American ship, which is the old "St. Louis." After modestly referring to her as the former "Queen of the Seas," they state that she was the crack ship, the "Ocean Greyhound," of the Cunard Line. On second thoughts, this is crossed out and American Line substituted. This is correct as far as the line is concerned, but it will be news to everybody acquainted with the history of the Atlantic ferry, to learn that the "St. Louis" was ever an ocean greyhound, or aspired to the title of "Queen of the Seas." If her history was carefully looked up it will be found that both she and her sister ship the "St. Paul," had to be practically rebuilt at Southampton after they had made a very few runs, and it is not within our knowledge that either of them ever achieved a record.

A Remarkable Proposition

IN ANOTHER portion of this issue is described a new system of propulsion for ships as proposed by Capt. Wm. P. Durtnall, M.I.M.E., who has long been a proponent of the electric drive for ships. The present suggestion is a radical departure from anything yet conceived, and is a suggestion that deserves a very careful study. It contemplates utilizing the high efficiency of the internal combustion engine, in conjunction with a non-condensing steam engine, in a closed circuit, and utilizing the heat of the exhaust from the internal combustion engine to prevent radiation losses from the steam part of the system. In the Still engine the waste gases of the internal combustion engine are used to generate steam in the jacket, which is applied to the under side of the piston, thus making it a combined steam and internal combustion engine. In the proposed system the internal combustion engine is used as a compressor, a fixed quantity of steam which has been generated in a flash boiler of small capacity being compressed to a high pressure and temperature, and delivered to a reservoir. From there it is passed through the cylinders of a reciprocating engine and exhausted back to a low pressure receiver with all its latent heat remaining in it, and is then recompressed to go through the cycle again. The reservoir on the high pressure side also supplies steam to the auxiliary machinery. The exhaust gases from the internal combustion engine are used to jacket the steam reservoirs and steam pipes, thus utilizing the heat remaining in them. The only loss will be that in the circulating water of the internal combustion engine. The radiation losses from the steam engine are prevented by jacketing from the exhaust gases of the compressor, and as there is no condenser, there is no rejection of large quantities of heat from the exhaust steam. The only source of loss from the engine would be from glands.

On the face of it the proposition looks as nearly perfect as it could be, but we have no figures to show what the actual thermal efficiency in an actual installation would be. The elimination of the donkey boiler for work in port is a very good point. Such questions as matter of space for a large powered installation and first cost may of course make the scheme less economical than it at first appears, but purely as a matter of securing high thermal efficiency it certainly looks very promising.

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News of the Shipping World

REPORTS from Germany tell of a new emergency steering gear, the invention of Captain John Ritter, of Hamburg. The gear is intended for use in case of an accident happening to any part of the gear right up to the rudder head, and provides a method of steering with the rudder itself, even when all connecting gear is gone. The invention is very simple, but withal very successful in application. A hole is drilled in the rudder close to the water line, and the outer edge is slotted to the edge of the plate, thus forming a slot that runs from the outer edge of the rudder plate terminating in a round hole. In case of the rudder gear being disabled, a small wire is dropped over the edge of the rudder plate, below the slot, and then pulled up evenly on each side, the natural result being that the wire slips into the slot, and then into the hole. A large wire is then bent on which has a stop rove onto it, at a distance far enough along to permit the free end of the wire to be brought up on deck, the stop coming up against the side of the rudder when the wire is drawn through the hole. A second wire is then rove through the hole from the opposite side, the stop coming up against the rudder in the same way. The free ends are brought up on deck and taken round the barrel ends of a winch, and it then becomes an easy matter to steer merely by running the winch one way or the other, the stops pulling the rudder round according to the direction the winch is run. The gear has been tried out at sea and found thoroughly serviceable.

A NOTABLE improvement on the Bolinder semi-Diesel engine has been perfected, and one of these new engines fitted into a tugboat on the Thames, the boat being the largest motor tug in Great Britain. The improvement is in the ignition device, and an improvement in the fuel injection apparatus. The new fuel injector, the use of compressed air for keeping the ignition bulb cool has been eliminated, the use of water for the same purpose having been discarded for some time. The new device consists essentially of a housing, injection nozzle, and a spindle, which is capable of adjustment from the starting platform. The device is fitted on top of the bulb, and it is possible to run the engine at full load with the ignition bulb so cool that it remains black. It is also possible to run the engine at light load indefinitely, the bulbs retaining sufficient heat for ignition. The ignition device, which is electrical, is mounted in a water-cooled housing, and by means of a sleeve can be projected into the ignition bulb or withdrawn as required. When it is withdrawn a valve on the sleeve seals the chamber containing the igniter, thus protecting it from the heat of combustion, and when it is pushed forward in the chamber for starting purposes, a valve on the other end of the sleeve closes the water-cooled housing. With this device starting from cold can be accomplished immediately, without the use of any lamps for warming the bulb. The makers claim that with the new fuel injection device the power is increased by 20 per cent. The new model is known as the N. E., and has been fitted in several vessels besides the one mentioned here.

LAST MONTH the firm of Workman & Clark, Belfast, delivered to the United Fruit Company of Boston and New York, the electrically propelled steamer "San Benito," which will be another unit of the great "White Fleet," so well known on the Atlantic coast. Messrs. Workman & Clark have built all this fleet of thirty-six vessels, and the latest one embodies in her construction the very latest method of propulsion. The propelling plant consists of three oil-fired boilers, fitted with superheaters, and delivering steam to a Curtis turbo alternator. The alternator supplies current to a three phase synchronous motor, coupled direct to the propeller shaft, and placed in a motor room right aft. There is thus no long shaft tunnel through the after holds, which represents a considerable gain in cargo space. The engines were built by the British Thompson Houston Company of Rugby. The vessel is built specially for the carriage of West Indian fruit, all the holds being insulated, while there is accommodation for a number of first class passengers. She is 340 feet by 46 feet by 31 feet 9 inches deep, and has a gross tonnage of 3724 tons. On her trial trip the machinery worked smoothly, and the vessel attained a speed well over that specified in the contract.

AN AMUSING instance of what can happen when a Government department has set its heart on economy is furnished by an account in a British shipping paper of the manoeuvres gone through in the transferring of three trawlers from one port to another. A number of Government trawlers have been laid up at Lowestoft as it did not pay to keep them fishing. The Department of Agriculture and Fisheries decided recently to send the three largest to a port further along the coast, Brightlingsea. In order to do this they proceeded as follows: First they had three special towropes made, and when these were ready, three torpedo boat destroyers were ordered from Harwich to Lowestoft in order to tow the trawlers to Brightlingsea. The destroyers were ordered to lay in the roads in Lowestoft, and harbor tugs would bring the trawlers out to them. In due course they arrived in the roads, and after waiting some time, signalled that there was too much wind and they were going back to Harwich, and would return when the weather got better. The real joke of the situation lies in the fact that the trawlers are practically new, their machinery in first class condition, and the bunkers amply supplied with coal to take them the required distance. A local boat owner stated that he would be willing to deliver the three of them under their own steam for about £100, while with the economical arrangements made by the Government it will cost about £1,500. This is bureaucracy at its best.

SPEAKING at the shipping and machinery exhibition at Olympia, London, on the progress of the motor ship, Mr. James Richardson, of the firm of William Beardmore and Sons, had some interesting facts to point out. He gave it as his opinion that the motor ship would be the cargo carrier of the future, and that it was possible that the motor would replace steam in much the same way that steam had replaced sail. Although the war held back the development of this class of vessel, the percentage of motor driven ships had risen from one half per cent. before the war to over two per cent. at

the present time. While in 1913 six thousand tons of ocean tonnage having oil engines were launched, last year's figures were eight times that much. Of tonnage under construction at present, well over ten per cent. was to be fitted with oil engines, while if number of ships was considered instead of tonnage, the percentage would be 15. Although the first cost of a Diesel engine installation was higher than a steam plant, the saving in operating costs was so high that the heavy initial capital expenditure was soon written off.

NEW YORK CITY, and more particularly the Waldorf Astoria Hotel in that city, was the scene of a very interesting function recently, when a complimentary dinner was tendered to Sir Joseph W. Isherwood, "in recognition of the distinguished honor conferred on him by His Britannic Majesty King George V., and the invaluable services he has rendered in promotion of world ship construction." The souvenir contains a long list of men distinguished in shipbuilding in the United States, and is a very handsome little document. The front page contains a very fine photograph of the honored guest, and enclosed is a very well written biography of Sir Joseph, covering his career to the present date. At the end of the biography is a half tone cut showing a midship section of a vessel constructed on the Isherwood system. The dinner was a very pleasing function, and showed a generous spirit on the part of those who thus assembled to do honor to one who was not a countryman, but whose splendid achievements have earned the commendation of men of all nations.

The Increased Use of Fuel Oil

FUEL oil, for use in oil burning equipped plants, has increased remarkably during the past year. J. J. Tyrell, in "Textile World," gives some interesting figures relative to this subject. Speaking of the oil burning boilers used by textile mills in New England and New Jersey, he says that approximately 50 textile plants with over 400 boilers were converted from coal to fuel oil. The oil consumption exceeds 4,500,000 barrels, displacing about 1,125,000 tons of coal per year.

The outstanding fuel oil installation in point of size, according to Mr. Tyrell, is that of the American Printing Company, at Fall River. The main storage consists of a concrete tank with a capacity of 640,000 gallons. This tank is about 30 feet from the boilers and oil is fed to the boilers by means of pumps. The storage tanks are provided with heating coils to hold the temperature of the oil to approximately 100°F. These heaters utilize the exhaust steam from the oil pumps.

In selecting apparatus to handle the oil some attention must be given to its quality; that is to say, whether it is light or heavy. It is my opinion, says Mr. Tyrell, that although the first cost of the apparatus to handle the heavier oil is greater, it is economical from an all-around viewpoint to install the apparatus to handle the heavier oil. Such installations will allow the engineer to take advantage of the market without regard to the nature of the oil.

Developments during the past year were chiefly concerned with the design and development of furnaces for high overloads. It is, of course, generally known that it is not economical to operate boilers on overload for any length of time. Yet, it is necessary to have them operate over short intervals to take care of big loads. In concluding, he says that the men who burn the oil ought to be given apparatus to guide them to the best way to get efficient results, and to be certain that they know the purpose of such apparatus when installed.

Flying—Is It Safe?

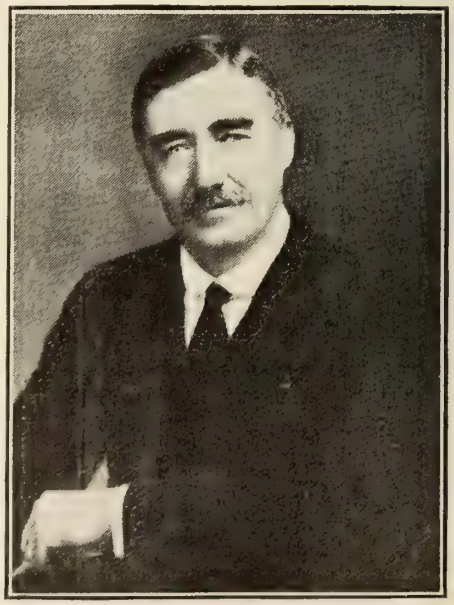
THE AVERAGE person is apt to consider the art of flying a decidedly dangerous one, and while not as safe, perhaps, as walking on terra-firma, it is by no means as bad as it is painted. Apart from the foolish stunts which some aviators persist in perpetrating, the commercial aspect of flying is becoming more rosy every day.

This is evidenced by the following authentic figures which have been issued by the Manufacturers' Aircraft Association, these results covering an aviation survey of the United States during the last six months.

It is stated that 1,200 commercial planes in operation have flown approximately 3,250,000 miles and that out of this number, about 1,000 are under the indirect supervision of responsible plane manufacturers or transportation companies. The remainder are the gypsy or foolhardy flyers some of whom have met with disaster, thus giving the industry, for such it is, a "black eye."

"Eight of the fatalities and thirty-two of the injuries in the last six months have been traced to the lack of terminals, routes and storm warnings, or to reckless stunting—errors which, according to the report, would have been corrected or prevented had there been a national air policy. In all the United States there are only 214 adequate municipal or civilian air ports, yet terminals are as necessary to aerial transport as they are to shipping or the railways. Deducting these preventable casualties, it is found that there was only one death for each 464,285 miles flown and only one injury for each 295,454 miles flown."

It is to be remembered that this record is for the United States alone. Britain has by no means been asleep in the development of commercial flying, and provided the various governments lend their support both by installing terminals, and providing financial aid for further experimental work, there is no reason why the next few years should not see a still further development in this industry. The airplane is invaluable in many cases where speed is the chief consideration, so that anything that will increase the safety of flying should be carefully fostered.



SIR J. W. ISHERWOOD

New System of Propulsion Described

A New System, Using High Pressure Steam Produced by Internal Combustion Compression, Feeding a Closed Circuit, is Described in the "Engineering Review" with a Diagram Drawn by the Inventor

IT IS CERTAIN that Mr. Arnold Bennett did not write "Milestones" for the special benefit of engineers. There are not enough of them, and they are on the whole not wealthy enough, to form an attractive target for a playwright. Nevertheless, it is unquestionable that the play is a liberal education for the engineer. To observe the conflict of policy between one generation and another, and to note how the protagonists of iron ships in place of wooden ships become, when they grow up and are "established," the defenders of iron ships against steel ships, is to realise the essential problem of engineering progress. Every technical training college should send its scholars to witness it at least once a year; every engineer who feels his ideas tending to crystallise should dissolve them again in the admirable spirit of this play. It summarises the struggle between the inner fires and the crust of convention, between the desire to advance, to improve, to speculate, and the bias towards the safe and the humdrum. The comedy of "Milestones" is being enacted day by day in every Victoria Street office, in every engineering institution, and in every factory and workshop. Usually the actors are quite unaware of the parts they are playing. The effect of "Milestones" is salutary, because it reveals themselves to themselves and forces upon them the question whether they are building their own policy upon the foundations of yesterday or of to-morrow.

The question is pertinent in regard to the problem of ship propulsion. During the 19th century British engineers played a leading part in propounding solutions and putting them to the test. But within the last 20 years this supremacy, which came to be looked upon as a kind of natural possession, has been qualified to a material extent. It is true that Britain was the pioneer of the steam turbine, and was not backward in developing the mechanical speed reduction gears which were necessary—on a wholly mechanical system—to overcome the disparity between the efficient speeds of the turbine and of the propellor. But the histories of the internal combustion engine and of electric propulsion are not so comforting. Claims are made that the internal combustion engine originated in Great Britain; that may be so, but it was not in Great Britain that it received its first commercial encouragement or was first developed into a recognized prime mover. Within the last few years much has been done to recover the ground lost in the early days. This effort cannot, however, wipe out the impression conveyed by the records and nomenclature of the internal combustion engine.

The case of electric propulsion for ships is still more striking. We owe the first practical suggestions on this subject chiefly to two British engineers—to the late Mr. Mavor and to Captain Wm. P. Durtnall, especially the latter, who has advocated the system with all the enthusiasm and determination of a Fulton. The original master patents were taken out by Captain Durtnall in 1905; they have now expired by lapse of time. Numerous discussions on the advantages of electric propulsion took place in the Press and before engineering institutions, but in Great Britain both the electrical engineering and the marine engineering worlds remained indifferent. If we want to know what electric propulsion means in practice we must go to America—which is equipping its Navy on the lines set out in Captain Durtnall's first patent and is now extending the system to merchant ships—and to Sweden, where there have been many merchant vessels fitted with electric drive. It has taken the immense demonstration afforded by the American Navy to awaken our Admiralty to a sense of the importance of electric propulsion on battleships and cruisers. An "experiment," it is rumoured, will be made on one of the new capital ships. Characteristically, this experiment will not be conducted on the lines of the latest developments of electric drive. The "Paragon" system designed by Captain Durtnall has been evolving since it was first outlined in the year 1903. Captain Durtnall has carried it beyond the point indicated even in his latest patents, but the Admiralty prefers to follow the lead of the U.S. Navy rather than make a true departure from precedent on its own responsibility. What is likely to happen, therefore, is that while the Admiralty is designing capital ships on a virtually obsolete system, other navies will be experimenting with methods as far in advance of the original electric drive as that was ahead of mechanical drive.

If these matters are kept in mind we are more likely to take the correct attitude towards the internal-combustion-steam power system which Captain Durtnall proposes for ordinary merchant ships. The system embodies a radical departure in marine engineering—more radical, in fact, than even

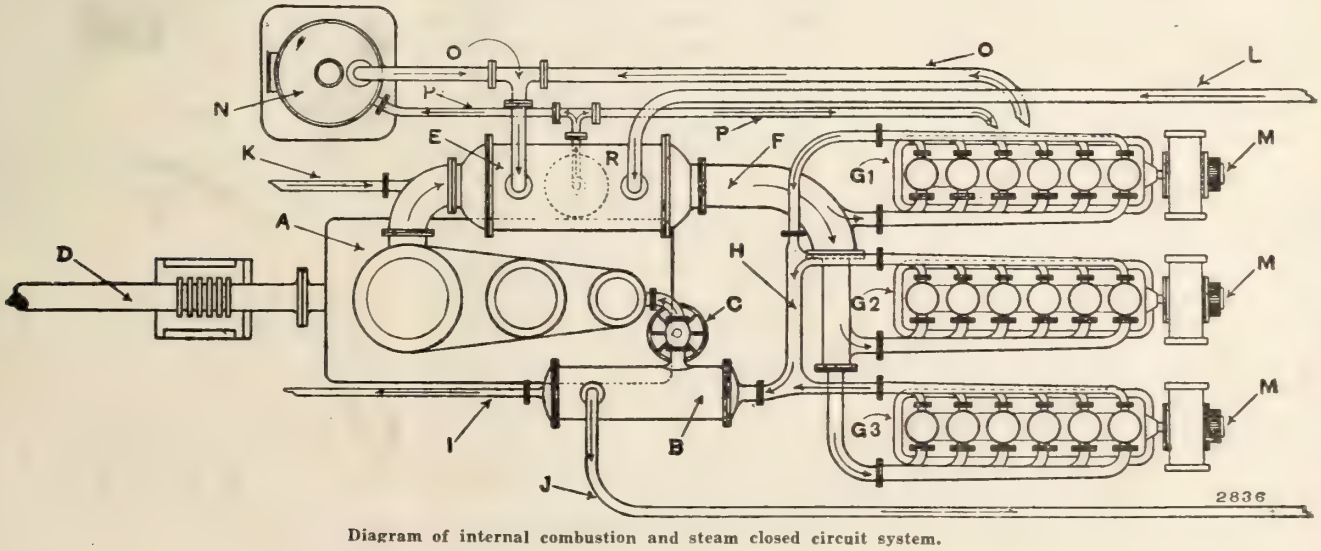


Diagram of internal combustion and steam closed circuit system.

the substitution of the turbine for the reciprocating engine, of the internal combustion engine for steam, or of oil-burning for coal. It is therefore likely to rouse the instinctive opposition of all the traditional elements in shipbuilding. On the other hand, it should appeal to those who feel that none of the existing methods of ship propulsion represents finality.

The main object of the new system is to utilise the high thermal efficiency of high-speed gas or oil engines in conjunction with the high efficiency of low-speed screw propellors. There is no need to dilate upon the limitations of internal combustion engine equipment on board ship—the necessity of using smaller and therefore inefficient propellors, and the difficulties of slowing and reversing. All we need note is that every one is avoided in the combination of internal combustion and steam which Captain Durtnall proposes.

The prime mover of the system is a multi-cylinder (say, six-cylinder) internal combustion steam compressor of special design. Steam is compressed on the lower side of the piston by power produced from internal combustion on the upper side of the piston. The compressed steam—at, say, 160 lb. gauge pressure—is delivered to a high pressure reservoir, from which it is taken to a multi-cylinder reversing marine engine (in this case running non-condensing), driving the propellor shaft at 60 or 70 revolutions per minute. The exhaust steam, instead of going to a condenser, and therefore wasting at least half its fuel heat in the cooling water—which has to be pumped overboard, at a considerable further cost in fuel consumption—is led to a low pressure reservoir, from which it is taken pressure. From this it goes back to the compressor and is regenerated into high-pressure steam, to be used again in the main engine.

Thus we have a closed circuit of steam heat energy. There is little friction in the circuit and little loss of heat. Additional economy is secured by adding the usual jacket and exhaust heat losses from the internal combustion process to the steam during recompression. The steam is, indeed, delivered to the driving engine at the temperature of highly superheated steam (650 degrees F.), without the use of either boilers or superheaters. A small flash-type boiler is installed to produce the initial quantity of steam required to fill the closed circuit, and also to boil up the heat transformer before starting. For a plant of 1,000 horse power a flash boiler of 100 gallons capacity will be adequate. The steam is, of course, used over and over again, and as the system has very few working parts or glands the leakage of steam is comparatively slight, and the amount of make-up water required—if any—will be very small. The "exciter" boiler, as it may be called can be separately fired by a small oil burner, or exhaust heat from the heat transformers can be partly used. Still another method of starting is to allow the internal combustion compressor to run and boil up, so producing the necessary initial steam.

The compressor, moreover, runs continuously at its most efficient speed—say, 500 revolutions per minute—independently of the varying speed and direction of the main engine. It works on the "Paragon" two-stroke, three-cycle method, giving an exhaust at a temperature of 400 degrees to 500 degrees F.; the exhaust heat is taken along the distribution pipes, the exhaust steam pipes, round the two reservoirs and also round the jackets of the main engine, thus forming a heat-lagging system. The final delivery to the atmosphere is silent and cool.

*This is described in Captain Durtnall's patents as a rotary heat transformer, as it transforms a small volume of high temperature gases on the internal combustion side into a large volume of low temperature gases on the steam side.

Explanation of Diagram of New System of Ship Propulsion.—A, main steam engine; B, high pressure reservoir; C, ordinary starting wheel for main engine; D, propeller shaft; E, low pressure reservoir; F, exhaust steam supply pipe rotary heat transformers; G, "Paragon" rotary heat transformers; H, high pressure delivery steam pipe from rotary heat transformers; I, high pressure steam supply to steering engines; J, high-pressure steam supply to auxiliary machinery and for heating, etc.; K, steam return pipe from steering engines; L, steam return pipe from auxiliaries; M, starting electric motors, also used as dynamos for lighting purposes, operating wireless apparatus, and charging accumulators; the accumulators (300 ampere-hour capacity, tractio ntype) supply current for starting the rotary heat transformers, and also are available for emergency lighting; N, flash-type oil-fired "exciter" boiler for generating low pressure steam for starting and boiling up the rotary heat transformers; O, steam pipe from the "exciter" boiler; also low pressure steam pipe from the cooling jackets of the rotary heat transformers; P, hot water pipe from low pressure reservoir to exciter boiler, and also to rotary heat transformers.

This equipment cuts out the main and donkey boilers, the main and auxiliary condensers, the feed and circulating pumps and their engines, and the uptakes and funnels. At the same time all the desirable features of the usual steam equipment are retained. Incidentally, several advantages are secured in connection with the driving of the auxiliary machinery. The equipment proposed for a ship of 1,000 horse power is, say, three "Paragon" compressors, all feeding into the high-pressure reservoir controlled not only with the main engine but with the power system for winches, pumps, steering gear and other auxiliary plant. At half vessel speed two of the compressors may be closed down, one being sufficient to provide the reduced quantity of high-pressure steam required. (The advantage of this sub-division on the score of reliability need not be emphasised.) When the vessel is in port all the winches and other loading and unloading machinery can likewise be operated from any one compressor, nothing in the way of special auxiliary power plant being necessary.

It is interesting to trace the almost complete analogy between this arrangement and the electric propulsion system. The smaller boiler corresponds to the exciter which produces the initial current for the generator. The internal combustion steam compressor is equivalent to the power-driven electric generator, and the high-pressure steam reservoir to the positive bus-bars. Futher, the main steam engine plays a part similar to the variable speed motor in the electric system, and the steam pipe system leading to this "motor" and to all auxiliary gear is the analogue of the electric circuits connected up to the bus-bars. The low-pressure reservoir and its connections form the negative circuits.

We may recall the fact that a combination of compression and closed steam circuit has been proposed for locomotive operation. Messrs. Hawthorn, Leslie and Company, Ltd., are converting a standard locomotive (with boiler, fire-box and tender removed) on such lines, and will therefore be able to compare its efficiency with that of an ordinary steam locomotive. The closed steam circuit is applicable also to electric railways. There the compressor is driven by an electric motor drawing its power from overhead wire or third rail. An important advantage revealed by Captain Durtnall's experiments in this connection is that regeneration can be effected without difficulty and with unprecedented efficiency.

It is to be hoped that the new marine system will be given a sea trial at an early date. The cost of a full-scale test should not be formidable, as an existing ship can be readily converted, its engine and propellor being retained. Such conversion will lead to lower fuel consumption than can be attained with ordinary Diesel engine equipment. In addition to the high efficiency of the "Paragon" cycle, there is the advantage that the exhaust heat and jacket losses are turned to good account.

On the one hand, it is perhaps unfortunate that the invention comes at a time when the industry of shipbuilding is in rather a depressed state and when the spirit of enterprise in general is not very active. On the other hand, there never was a time when economies in fuel and in transport were more desirable. Anything which offers a radical improvement upon traditional methods should be warmly welcomed and carefully considered upon its merits. If British shipbuilders are not prepared to take risks in trying-out novel methods of propulsion they will see their backwardness in the electric propulsion field repeated in other directions until the initiative passes completely to their competitors abroad.

Fort William:—Grain storage capacity is being strained to the limit by the shipments coming into Port Arthur and Fort William. There were on Oct. 16, 21,000,000 bushels of all grains held here and one week the total rose by two and one half million bushels in spite of the fact that eight and a half million bushels were shipped. The congestion in Montreal has resulted in a lot of grain being shipped to Buffalo.

MARINE NEWS FROM EVERY SOURCE

London:—The Spanish Government has approved of a programme consisting of four fast cruisers, six destroyers, 28 submarines, and 20 gunboats, the construction to be spread over a period of six years.

Kingston:—The "Toronto" of the Canada Steamship Lines will not be lengthened as was intended, the directors feeling that the past season's business did not warrant the expenditure. The work will be posponed for this year at least.

Sarnia:—The steamer J. C. Ford and the barge Owen arrived in Port Huron with a cargo of pulpwood, after being several days overdue. The master of the Ford stated on his arrival that it was no uncommon thing for them to be overdue, as he had orders not to take any chances in uncertain weather, and sometimes would shelter for several days rather than run any risks.

Montreal:—Following the cut announced recently, the White Star Line have announced another cut in Trans-Atlantic passenger rates to Finnish and Scandinavian ports. The amount of the cut is $20 in second cabin fares.

London:—The liners "Scotian" and "Victorian" of the C. P. O. S., have been altered and refitted for the purpose of carrying troops to India, the work being done in Antwerp. The vessels have been chartered by the Government as an experiment in economy, it having been found very difficult to get vessels regularly employed in the eastern trade at the time they were needed. The alterations to these two vessels will not prevent them being readily converted to their original use in the North Atlantic passenger business.

Niagara Falls:—Captain Richard Frederick Carter, who built the famous "Maid of the Mist" and commanded her for many years, died here at the age of seventy-five, on Oct. 6. Captain Carter came to Clifton, as it then was, at the age of fifteen, and has lived there ever since. He was very prominent in civic affairs, having been mayor on two occasions, and alderman for several terms. He was also Water Commissioner. He was also interested for about fifteen years in an electrical business which he founded. He leaves a family of two sons and five daughters.

Belleville:—Captain Charles Wesley Farrington, well known as a lake mariner, died here recently at the age of 84 years, after an illness of some months. Deceased had spent all his life around the lakes, especially around the Bay of Quinte. He leaves a widow, two sons, and a daughter.

Montreal:—Mr. R. B. Teakle, manager of the Canadian Government Merchant Marine when made cognizant of the charges made against the fleet by Mr. A. R. McMaster gave a specific denial to them all. Mr. Teakle stated that while it was up to the executive to give an official statement, he could himself deny the charges dealing with the alleged absence of cargoes, retention of crews while the ships were laid up, and the undue length of stay in ports.

Vancouver:—The "Canadian Freighter", the last of the steamers for the C. G. M. M. on the ways at Vancouver was launched from the yard of the Coughland Co., on Oct. 13th. The christening ceremony was performed by Mrs. Wallace.

Amherstburg:—The United States War Department has awarded contracts to the Dunbar and Sullivan Dredging Co., to perform extensive work on the Livingstone Channel, which will take about three years to complete, and give employment to a large number of men.

London:—The activities of the world famous firm of Harland & Wolff are now to be extended to the Thames. It is reported that this firm has secured a large amount of property on the Thames side, and intend to erect a plant for ship repairing and re-conditioning. All classes of craft from the largest to the smallest and will be handled, and it is stated that the firm will do the entire repair work of the floating plant of the Port of London Authority.

Montreal:—The death occurred in the Royal Victoria Hospital of this city, on Oct. 1st of Captain Harris Pickles, due to pneumonia. He was to have commanded the ship now being fitted out at Quebec for the purpose of Arctic explorations on behalf of the Dominion Government. The deceased gentleman was fifty-four years of age, and served for many years in the merchant marine, and was for some years in charge of the expeditions round the Labrador coast conducted by Dr. Grenfell. He was also in command of the ship sent to the relief of the Greenland expedition under McMillan.

Toronto:—While engaged in loading the "City of Ottawa" belonging to the Canada steamship Lines in this port, Harry Rachkowsky, aged 35, was fatally injured. A bale of waste fell from its sling, and hit the deceased, fracturing his skull, causing death about an hour after the accident.

Montreal.—The world's largest ship, the "Majestic," is expected to start on the New York and Southampton run early in 1922. This fact directs attention to the docking facilities for the liner at New York. The piers at New York were extended just previous to the war to accommodate the large liners that were placed on the run about that time, in order that their long hulls might be protected from injury caused by the traffic up and down the Hudson River. These new piers with their extensions will be a tight fit indeed for the new liner "Majestic." The docking experts in New York expect that the landing of the "Majestic" will be as big a task as any one they have yet had to take care of. New York, as it is well known, is probably the hardest port in the world in which to dock a large ocean liner, due to the fact that it is the only port where the docks are at right angles to a river in which strong tides flow regularly.

Opposite the dock in New York where the "Majestic" will make a landing, the new liner must come to a stop and swing its bulk crosswise in the flowing tide and hold it there until it has nosed its way into the berth, which has been assigned to the ship. It has been estimated that from 12 to 20 tugs will be used to bring the "Majestic" into her berth. Details for the actual landing of the steamer, of course, have not been worked out, but at the present time, as before stated it is a subject of a great deal of discussion.

Montreal.—The little 760 ton steamer "Baychimo," of the Hudson's Bay Company, arrived in Montreal about the first of October, after a two-months' trip. The vessel went furthest north of any of the company's fleet and established a new trading post at Pond's Inlet, Baffins' Land. The "Baychimo" was the first freighter to go up the inlet with the possible exception of the old Dundee whalers, and experienced little or no difficulty with ice, contrary to expectations. They found, however, that the inlet abounds in seals. The "Baychimo" carried a powerful wireless, with a sending

range of 2,000 miles, and a hearing range of some 5,000 or 6,000 miles. Therefore, the steamer was in touch with civilization all the time during her trip. The wireless had been specially constructed in order to withstand the strength of the northern gales with the accompanying snow and sleet.

Another ship of the Hudson's Bay Company, the "Nascopie," is now loading 700 reindeer at a Norwegian port to be delivered at Pond's Inlet before the winter sets in. There European reindeer are to be crossed with the Canadian breed in order to improve the Canadian species. The experiment, both from a navigational point of view and otherwise, is being watched with great interest.

Montreal:—According to reports in the Montreal press the activity at that port this season has been greater than at any other port on the North American Continent. The electrification of the railroads on the Harbor Commissioners' property has been almost completed, the total distance being ten miles. Grain has been shipped at the rate of twenty-five millions of bushels per month, while the passenger business has been quite up to standard.

Toronto:—The J. E. McKee, owned by the Canadian Government Merchant Marine, arrived in this port with a cargo of sugar from St. John, N.B., 600 tons of which will be unloaded here, 400 tons having been unloaded at Montreal, and the balance will be taken to Port Arthur. The J. A. McKee is regularly employed in carrying coal from Cape Breton to Levis, for the use of the Canadian National Railroads, and that business having been closed for the season, she has been transferred to the lake trade.

Kingston:—George Henderson, for 50 years a marine engineer with the Montreal Transportation Co., died in this city on October 18th. The deceased was 74 years of age and had lived most of his life in Kingston, having been born in Millhaven.

Toronto:—In connection with the death of Anthony Rachowsky, who was killed while loading the steamer "City of Ottawa" at the foot of Bay Street on October 12th, the coroner's jury brought in a verdict of accidental death, and at the same time censured the deceased's fellow workman for carelessness in fastening the sling on the bale that caused the death.

St. Catharines:—Number three lock Port Dalhousie, was badly damaged by the wooden steamer "Robert R. Rhodes," which ran into the head gates and carried them away. The steamer was carried into the lower level, but was not seriously damaged. The gates have now been repaired, and traffic resumed.

London: Figures on shipbuilding for the quarter ending September 30th show that the total tonnage under construction for the world amounted to 5,542,000 gross tons. This is a reduction of more than 2,000,000 tons from the figures of January 1st. The amount under construction is 434,000 tons while that in British yards amounts to 2,094,000 tons.

Vancouver:—The probable cause of the flooding of the hold of the "Canadian Importer" is stated by news advices from Vancouver to be a broken pipe in the hold. It is stated that the pipe was broken where it passed through the bulkhead, close to the skin of the ship.

Montreal:—The Chambre de Commerce of Montreal has once more gone on record as being opposed to the St. Lawrence canal scheme, fostered by the International Waterways Committee. The Chambre de Commerce has again endorsed the Georgian Bay canal scheme.

Vancouver:—The Burrard Dry Dock Company has been incorporated, to build a dry dock at Burrard Inlet. Is is understood that negotiations that have been going on with the Dominion Government for some time in connection with a subsidy have now been definitely concluded. The parties interested are J. J. Coughlan and Clarence Wallace, and the cost of the dock will be about $2,500,000.

London:—The Royal Institute of British Architects have decided to award the Greissel prize this year for the best design for a mooring mast for air ships. The air ministry is much interested in the idea, and has offered to nominate an expert to assist in judging the designs submitted.

Montreal:—Considerable damage was done to the blacksmith's shop at the yards of the Fraser Brace Company, St. Patrick St, by a fire which occurred early in the forenoon. The building itself was worth about $1.000 but there were several thousand dollars worth of machinery in it. During the fire a container of compressed air burst, due to the expansion of the air by heat, and caused a team of horses on one of the fire wagons to bolt. The flames were soon subdued.

OMMISSION

In the description of the motor driven cargo and passenger vessel in last issue of Marine Engineering of Canada, the name of the designer was unfortunately omitted. The vessel was designed by Mr. Walter Lambert of Montreal, and we regret that his name was omitted from the description through an error in the composing room.

SEARCHLIGHT SEEN 140 MILES

A few days ago in New York a new searchlight the most powerful one in the world was given a preliminary test. The searchlight develops 1,400,000 candle power, and its manufacturers claim it can shoot a ray of light thirty miles into the air. The manufacturers, the Sperry Gyroscope Co., claim that the shaft of light can be seen for a distance of one hundred and forty miles at sea.

The practical uses of the light, the manufacturers state, will be as a beacon for lighthouses, and further it might be extremely useful to aviators in flying at night. If it can be of use to mariners in coastwise navigation, it would be one of the most useful aids to shipping, that has been developed in the last decade. Its usefulness in thick and foggy weather has not yet been demonstrated, and there has been no report as to the cost and maintenance cost of the light. It is stated that intensity of the light is almost equal to the strength of the sun's rays at the surface of the earth.

A SUBMARINE RIVETING TOOL

Considerable interest is being displayed in Great Britain over a new riveting gun, which can insert rivets or bolts in a ship's hull under water, for salvaging or repairing purposes. The tool only weighs 15 pounds, and resembles a pneumatic hammer in appearance. It consists of three parts, the barrel, the holder, and the bolt which fits into the barrel. There is a copper washer in the barrel which acts as a watertight compartment for the bolt and charge. A charge of powder something less than that in a .303 cartridge, is placed behind the bolt, which is fired by depressing a safety device, and pushing the holder, when sufficient explosive force is generated, to enable the bolt to pierce a five eight plate. The end of the bolt remaining outside the plate is already threaded, enabling a patch to be fastened on, the part of the bolt which is in the plate being immovably fixed. The apparatus is made by the Temple Cox Research Co., Dacre House. Dean Farrar Street, Westminster, London.

James Howden & Co. of America, Wellsville, N.Y., have issued a catalogue or bulletin describing their high speed, direct connected engines for ship lighting generators. This firm is the American branch of the famous Howden firm in the old country, so well known for their forced draft installations. The bulletin contains useful information about the engine, and a partial list of users on this side of the ocean. The company have branches in Montreal and Vancouver, B.C.

The Toronto Harbor Commission have given an option on ten acres of property at $60,000 an acre. The type of industry which proposes locating in Toronto is so far a secret although the very location chosen leads one to believe the new plant will be engaged in the metal working field.

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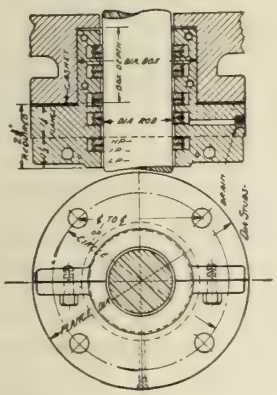

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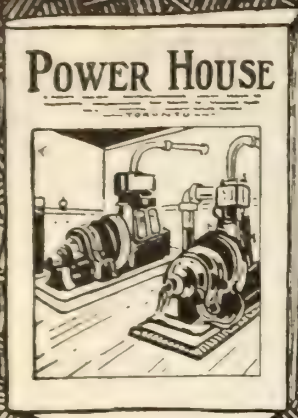

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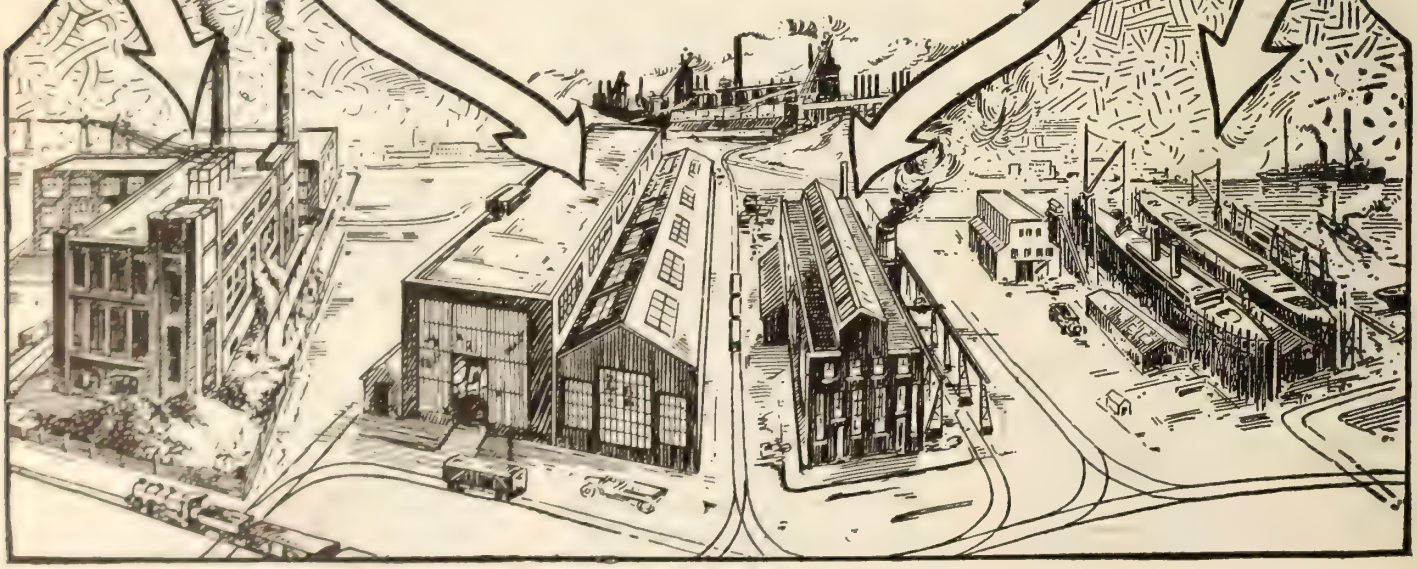

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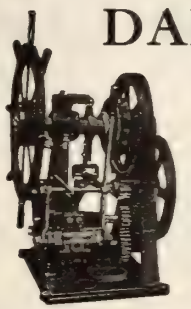

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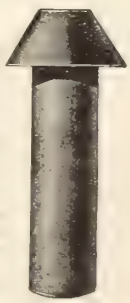

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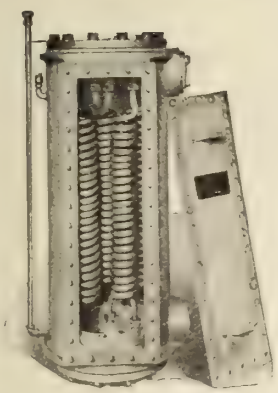

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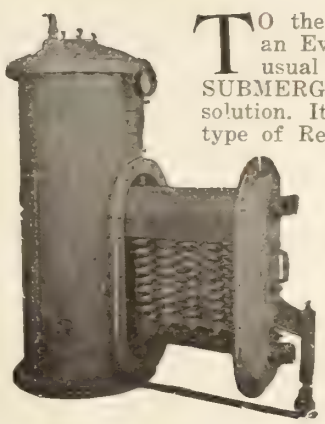

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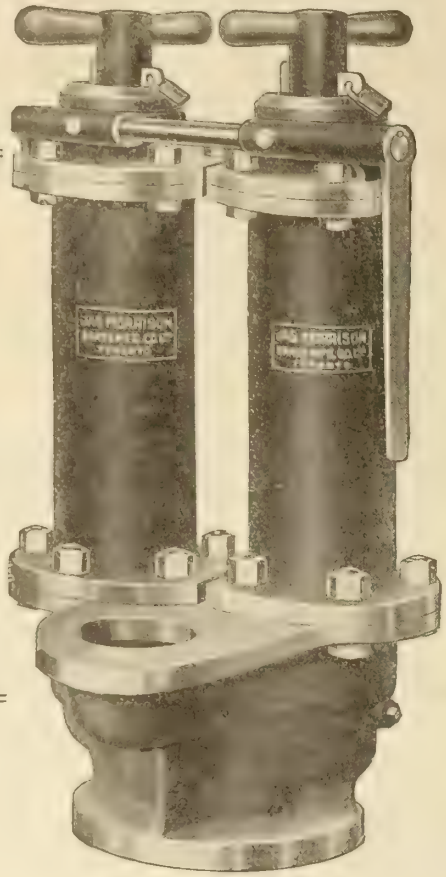

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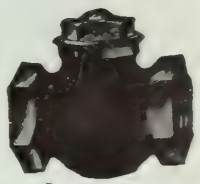

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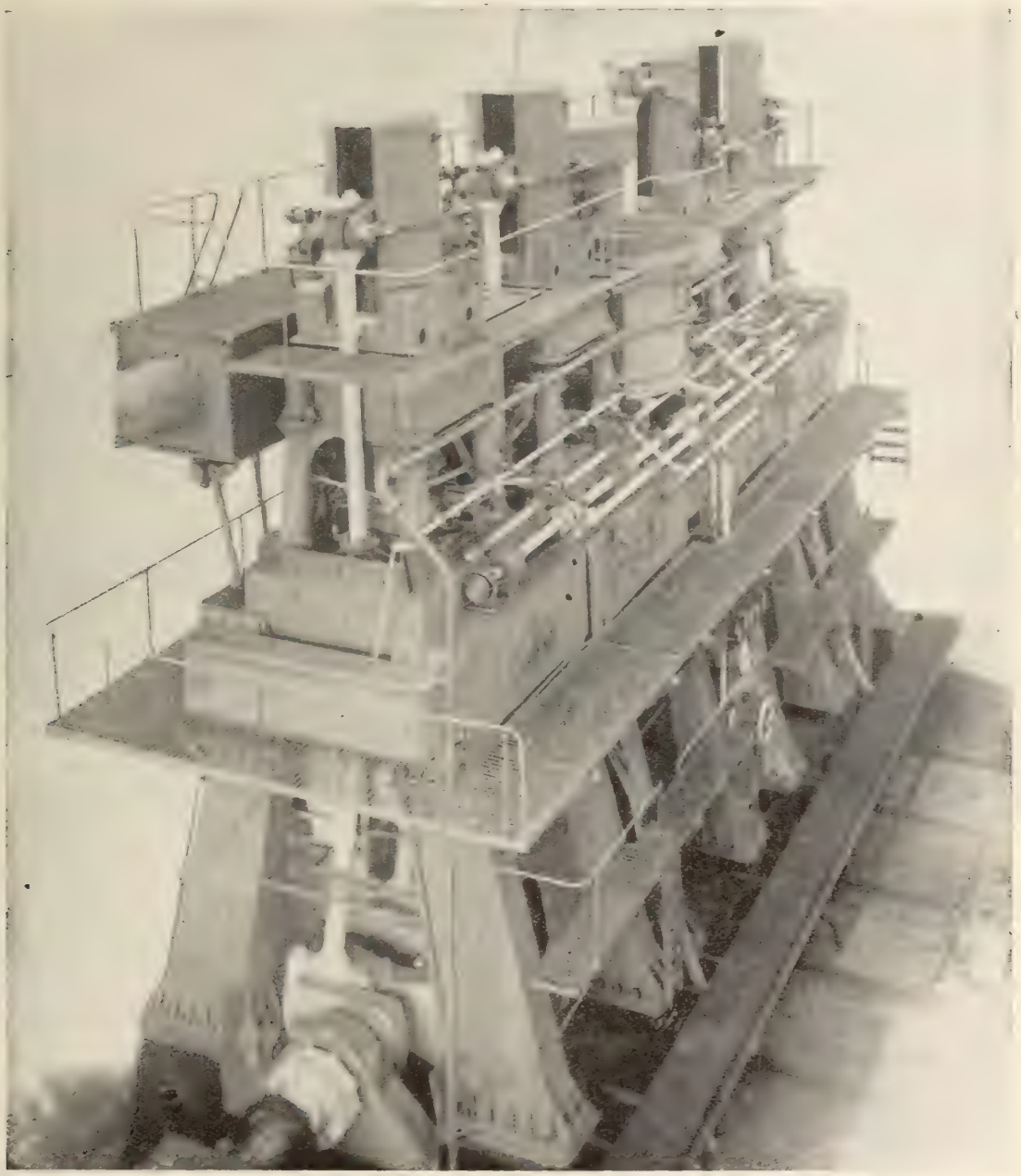

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"Funny Thing That Tariff"—by J. K. Munro. This number of MACLEAN'S has four timely articles dealing with Big Politics, the whimsical observations of J. K. Munro are, as usual, full of amusement as well as information. Munro just can't help seeing the funny side of politicians and politics. Of Ottawa and Parliament Hill he makes a sort of continuous vaudeville performance. He gets some big laughs out of election activities.

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has been a watcher from the hilltops longer than most of the present-day school of Canadian writing men. As usual, in his article on the Dominion political situation in November 15th issue of MACLEAN'S MAGAZINE, he strictly maintains the detached attitude of the true journalist. But in his survey of the field and the political gladiators there is a warmth and an intimacy with both the men and the situations that could be imparted only by one who has long been a close and observant student of governments both Dominion and Imperial. This article appears under the caption—

"All Three Are Good Men."

"Our Election Enigma—Women!"—by Agnes C. Laut. How are they going to vote? Are they going to vote at all? Are they going to realize citizenship? These are some of the potent questions asked and answered by one of Canada's leading women authors—Agnes C. Laut. What influence will woman with her vote bear on Canadian politics? Will the woman wage-earner join the ranks of labor when it comes to the battle of the ballots? There is a fund of information for both men and women readers in this right-on-the-minute summary of Miss Laut's.

Other Gripping Features in This Issue:

If you like red-blooded fiction with the tang of the race track in it, W. A. Fraser's short story, **"The Thumb Print,"** is sure to satisfy. It's a case of a pair of sleek double-crossers being neatly double-crossed by what they deemed a rich double-crosser.

"Whose Bride Was Mary," is a delightful, fast-reading short story of perplexing situations from the pen of Ethel Penman H—

The first of Rev. R. G. MacBeth's thrilling articles on old days with the Mounted Police, "Policing the Prairies," is given complete in this issue. Learn how the Mounties first invaded the prairies in the days of Indian scalp-takers and white "bad men," and in the face of tremendous difficulties.

Incidentally there are two generous instalments of the serials, "Mostly Sally," by Pelham Grenville Wodehouse, and "The Yellow Streak," by Valentine Williams.

What do you know about "Relativity" and the Einstein Theory?—An illuminating summary of Sir Oliver Lodge's explanation of it is one of the many interesting topics dealt with in MACLEAN'S "Review of Reviews."

"Food Facts You Should Know," by William Fleming French, and the regular departments devoted to Finance, Current Humor and Women and Their Work, complete a number bristling with good things.

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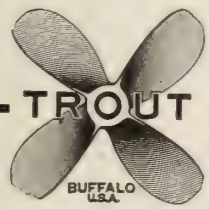

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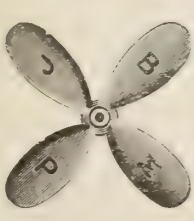

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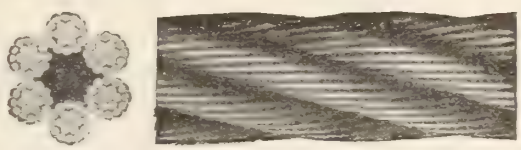

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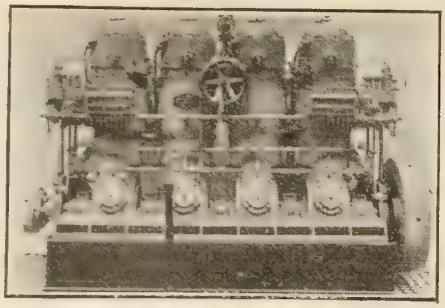

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MARINE ENGINEERING
OF CANADA

Volume XI . NOVEMBER 1921 Number 11

A Guide to the Canadian Marine Certificate

In This Article the Subject of Riveted Joints Is Further Gone Into and the General Features of Cap and Butt Strap Joints Are Explained

By T. H. FENNER

IN THE last article we spoke of the strength of riveted joints. and the method of getting approximately the correct percentage of strength with different types. The joint we were considering was a single riveted lap joint, and we found that with the sizes given, that is a pitch of 2 inches, and a rivet diameter of ⅝ inch, with a plate 5/16 inch thick, we got a plate percentage much greater than the rivet percentage. In most joints this percentage should be approximately the same for both the plate and the rivets.

Now it will be plain to the reader, on consideration, that if the percentage of plate strength is found to be much higher than the percentage of rivet strength, the reason must be that the pitch is long in comparison with the diameter of the rivets. If we shorten the pitch we will at once decrease the plate strength and increase the rivet strength without altering any other sizes. We do not know just how much but we can find out very easily. We have seen that the formula for the percentage of plate strength is

$$\frac{P}{P-D} \times 100 = \text{percentage.}$$

Finding Pitch From Percentage

Now if we know the percentage we want to have, we can find out the pitch and diameter of rivet to give this percentage by merely substituting in the formula.

We shall then have as follows, if we want, say 54 per cent for the joint:

$$\frac{P-D}{P} \times 100 = 54$$

$$P-D = \frac{54}{100} P$$

$$P-D = 54\ P$$

$$P-.54\ P = D$$

$$.46\ P = D$$

That is in order to get the percentage of strength required we must make the diameter of the rivets equal to a little less than half the pitch. Now the pitch that we used in the previous example was 2 inches. The diameter then would be .46 x 2=.92 which is too large a rivet for a 5/16 plate. We must use a rivet whose diameter is approximately equal to the thickness of two plates, that is ⅝ inch. We shall then have:

$$.46\ P = D$$

$$.46\ P = .625$$

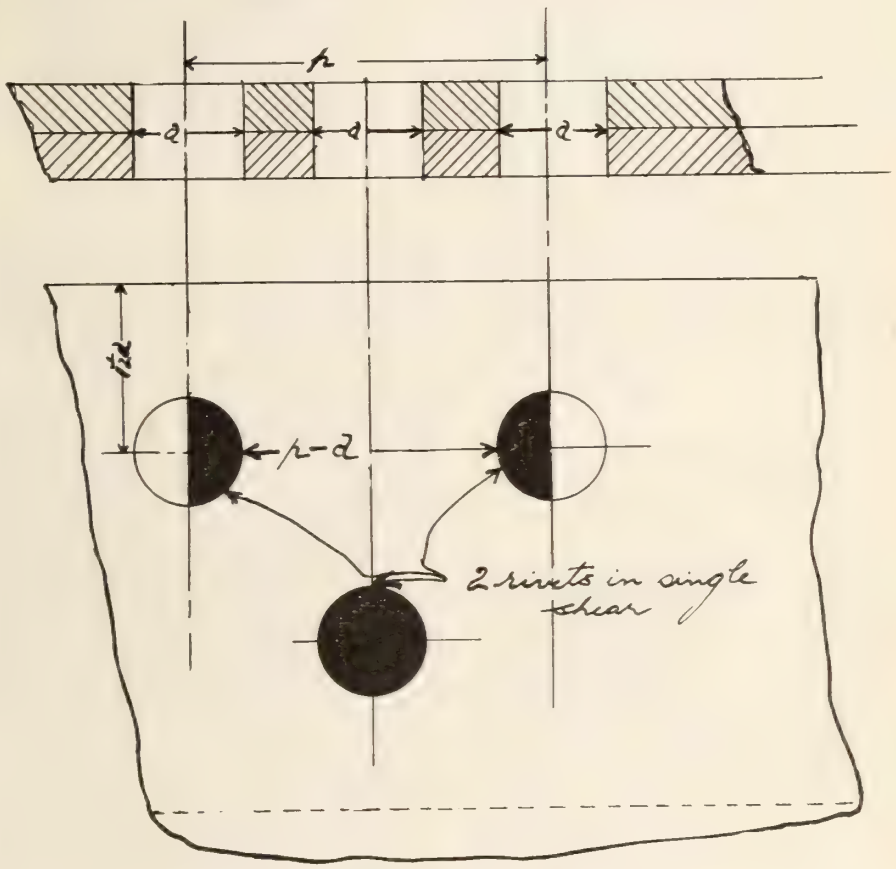
$$P = \frac{.625}{.46}$$

$$P = 1.358$$

This gives a pitch of 1.358 inches, which is practically 1 and ⅜ inches. We can now try our formula with these sizes and see how close we come to a satisfactory result.

$$\frac{P-D}{P} \times 100 = \text{percentage}$$

$$\frac{1.375-.625}{1.375} \times 100 = 54.5 \text{ per cent.}$$



Double Riveted Lap Joint.

Now let us see how the rivet strength will agree with this.

$$\frac{a \times n \times c}{p \times t} \times 100 = \text{percentage.}$$

$$\frac{.3 \times 1 \times .8}{1.375 \times .3125} \times 100 = 55.8 \text{ per cent.}$$

Thus we have a plate efficiency of 54.4 per cent. and a rivet efficiency of 55.8 per cent., which is a very well balanced joint. This of course is the simplest form of joint, and we might not be able to get such a close balance in a different form of joint without a good deal more calculating.

The Double Riveted Lap

We can now consider the next type of joint, which is known as the double rivet

ed lap joint, because instead of the single row of rivets there are two rows, arranged in staggered formation, that is, pitch centres of one row coming in between the pitch centres of the other row. This form of joint is found on small diameter drums or domes, but never in large boilers in the longitudinal seams. The girth seams of Scotch marine boilers have sometimes double riveted lap joints, but the double riveting in these cases is for the purpose of making a tighter joint, and not from the point of view of increasing strength. As we pointed out in the last lesson the stress on this seam is only half that on the longitudinal so that if the latter joint has a strength of 82 per cent. a strength of 41 per cent. would be sufficient on the ring seam. This would easily be obtained with single riveting, but where there are thick plates and high pressures such as exist in large Scotch boilers a double riveted lap is introduced to give greater steam tightness.

A Typical Case

The illustration herewith shows a double riveted lap joint, and the calculation of its strength is made in a practically similar manner to that of the single riveted joint. The plate strength will be calculated from the formula

$$\frac{P=P}{P} \times 100 = \text{percentage of plate}$$

and the plate strength from the formula

$$\frac{a \times n \times c}{p \times t} \times 100 = \text{percentage of rivets}$$

In this case however, the number of rivets in a pitch will be two instead of one, as in the first case, and the result will be an increase in rivet strength over that in the single riveted joint. As the pitch is usually greater than in the single riveted joint, the rivet diameter is also somewhat greater, this joint being used on plates of greater thickness than the single riveted type is used for. The percentage of strength of a joint of this kind is usually in the neighborhood of 70 to 72 per cent. Let us assume a pitch, thickness of plate and diameter of rivet and work out the strength of the joint. Take the pitch as 2½ inches. the plate as ⅜ thick, and the rivet diameter as ¾ inch.

Then we shall have, substituting figures for letters in the formula

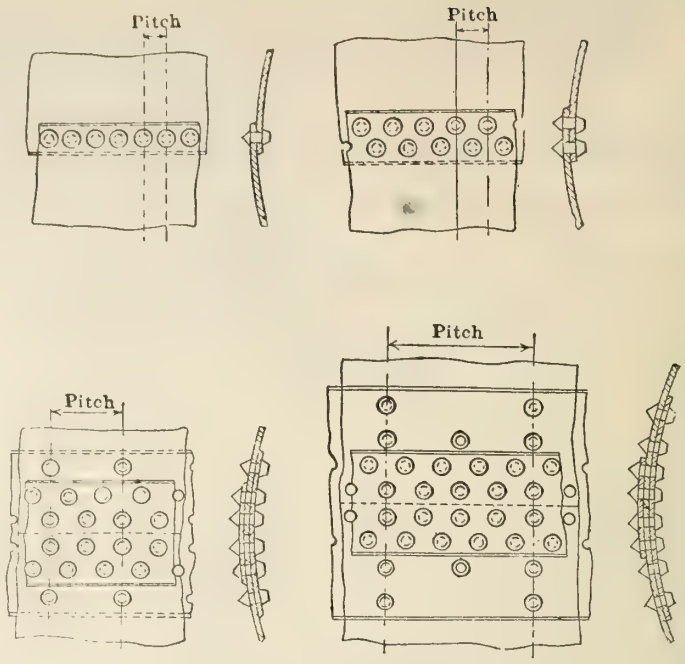
[illegible] x 100 = 70 per cent.

for the plate strength and

$$\frac{.44 \times 2 \times .8}{2.5 \times 3.8} \times 100 = 74.6 \text{ per cent.}$$

for the rivet strength.

The least percentage is the plate strength, and this would be used in calculating the shell strength of the boiler. A triple riveted lap joint would be calculated in precisely the same way excepting that the number of rivets in a pitch would be three instead of two. A



triple riveted lap joint is rarely met with in marine practice, so that it is not likely to be encountered as an examination question.

Butt Strap Joints

Lap joints in a circular shell have the disadvantaage of not preserving the true circular form of the shell. as one plate must be bent under the other to some extent when the lap is made. This is often the cause of cracks developing after a certain length of time, and further a lap joint cannot be made with a much greater strength than 75 per cent. If instead of lapping the plates over each other, the edges are brought together, and a cover plate laid over them which is riveted to both the adjoining plates, we hall have a joint that besides bein' strong, will preserve the circular form of the shell, and will therefore be a much better joint all round. A joint of this type can be designed for as high a percentage of strength as 92 but they are usually in the neighborhood of 82 to 86 per cent. We can show where we get this extra strength by an illustration.

In the accompanying figure of a triple riveted butt strap joint with double straps, the inside strap extending over the three rows of rivets, on each side of the butt, while the outside strap only extends over two rows on each side of the butt, that the pitch of rivets at the outside row is just double that of the pitch of the two inside rows of rivets. Now we saw earlier in this article that if the pitch is increased relatively to the size of the rivet, the percentage will increase as far as the plate strength is concerned. We have also seen that the weakest part of a joint is the plate strength at the outside row of rivets, and if we have the greatest possible strength at this place, the rest of the joint will be proportionately strong. This strength is assured in the joint illustrated by making the pitch of rivets at the outside row twice as great as those of the inner rows, while the strength of the rivet section is very greatly increased by the fact that the rivets on the two inside rows pass through the shell and the two cover plates, while the outer row of rivets passes through the shell plate and one cover plate only. A rivet that passes through three plates in the manner described is said to be in double shear, and its shearing strength is increased by 1¾ times that of a rivet in single shear. By double shear is meant the fact that the rivet would have to be sheared at two different parts of its length in order to fail, as can be plainly seen in the illustration.

Now let us take figures representing about the usual practice in this type of joint, and figure out the efficiency. I have before me the drawings of a Scotch marine boiler 14 feet diameter by 11 feet 8 inches long. and will take the dimensions of the longitudinal joint on that boiler as an example. The plate is 1-⅛ thick, and the outside pitch is 8.5 inches. The plate strength would then be, the rivets being 1-3/16ths diameter

$$\frac{8.5 - 1.1875}{8.5} \times 100 = 86.02 \text{ per cent.}$$

Now the rivet area will be equal to the area of all the rivets in the joint. We see that we have four rivets in double shear, which is 4 x 1¾, 7 and one in double shear making 8 altogether. The relation of rivet strength to plate strength is taken as 27/28 so that our formula for rivet section would be as follows

$$\frac{19 \times 19 \times .7854 \times 8 \times .9 \times 2 \times 8}{16 \times 16 \times 17 \times 9} \times 100 =$$

83.34 per cent.

This shows a well designed joint, the least percentage of which is 83,34, and

Continued on page 15

A Review of Conditions in the Shipping World

The Presidential Address of Sir W. J. Noble to the North East Coast Institution of Engineers and Shipbuilders. This is of Great Interest as Coming From a Man of High Authority

FOR thirty-seven years the North-East Coast Institution of Engineers and Shipbuilders has carried on its work with ever increasing usefulness. Through all that long period there has been a succession of presidents whose intimate technical knowledge of engineering and shipbuilding has been a source of strength to the Institution and has done much to increase and extend its sphere of operations. The president who has just vacated office was of like nature; his eminence in his own profession gave distinction and strength to the Institution.

And now in this year of grace, 1921, you have broken new ground. For the first time you have elected a shipowner as president and thereby you have honored me in a special and peculiar way. your past presidents have found it difficult to express their thanks for the honor conferred upon them—an honor which any man, however eminent in the profession, might well covet—but I find that words of any kind are altogether inadequate to convey my appreciation of this venture of faith on your part. This I can say, however, that throughout my active business life few things have given me more gratification than the call to fill the post of president of your influential Institution, and I can assure you that, so far as in me lies, I will endeavor to fulfil the duties of this high office in such a way that the dignity and usefulness of the Institution may in no way suffer.

After all, it is not strange that in a progressive body of shipbuilders and engineers, such as the Institution represents, you should have decided to associate in this way the great shipowning interests of the North-East Coast with the peculiar work of the Institution. Shipowners are, and ought to be, intensely interested in all you undertake. I hope my year of office may be marked by every shipowner in this district identifying himself with your activities. It is true the shipbuilder is commercially dependent on the shipowner. On the other hand, it is to the shipbuilder and the engineer that the shipowners look to develop in ever-increasing efficiency the ships by which they carry on their business—a business which must always be ready to face competition with the whole world. They have not been disappointed in the past and I know that the inventive genius of naval architects and engineers, such as those who are members of this Institution, will not fail them in the future. This, of course, assumes that in the ranks of the personnel of our industrial establishments there is always going on a process of developing and maintaining of professional proficiency. In the field of endeavor, the technical institution occupies the position which, in realms of pre-graduate education, is filled by the University. For this reason alone, and there are others, the Institution deserves the fullest measure of practical support that we can give to it. If anyone should be doubtful as to the truth of this statement, I cannot do better than advise him to read the Presidential Address delivered last year by my predecessor.

It is not my function to-night to address you on some of the technical problems which occupy your attention; indeed, it would be impertinent for me to attempt to do so, even if I felt so disposed—but there are questions of general interest about which I shall venture to speak: questions which form common ground among us, affecting vitally the industries we represent, and if we have the larger vision, affecting no less vitally our national position, caught as we are to-day in the strangling coils of world movements.

In the first place I feel that I ought to refer to the position of our Mercantile Marine. We were proud of our merchant navy before the war, but it was the searchlight of the war which revealed to us its true relation to the life of the nation. Few among us ever thought of the peaceful merchantmen as an instrument of war, and yet our merchant fleet became one of our fighting units, almost, if not quite, as important as our warship fleet. It was found that the one was complementary to the other and we know what heroic work was done by the officers and crews of merchant ships. Without those men and without those ships neither we nor our Allies could have issued victorious from that stupendous conflict. As a matter of sober fact a predominant mercantile marine is necessary for the safety and well-being of the whole community. No one can view any decline in the maritime supremacy of this country without alarm. Only across the sea can we gain access to the markets of the world, and therefore our merchant fleet is our only means of trading at an economic advantage with other countries.

Cheap Food and Raw Materials

Cheap food and cheap raw materials are the foundation of our commercial prosperity. They cannot be obtained unless we have tonnage sufficient to bring them at cheap rates. One hundred years ago the population of this country was about 16 millions. Presumably that was the population which the land could feed comfortably. Nowadays, in spite of our war losses, we have, owing to industrial expansion, about 47 millions to feed and clothe, and an aspiration that the general standard of living should be raised for the mass of the people. Therefore, we must import food and raw materials to keep us going throughout the whole gamut of our national life.

When war broke out in August, 1914, the world's steam tonnage was 42½ million tons gross. It had grown year by year following the rapid expansion of the world's commerce caused by the application to industry of steam and electrical power. Of this total the United Kingdom tonnage was represented by nearly 19 million tons—44½ per cent. of the whole, but in real efficiency a much higher percentage. Steamers of 1,600 tons gross are usually taken as the standard for overseas trading and 90 per cent. of the United Kingdom tonnage was of this size and upwards. Further, 68 per cent. of this class of tonnage was under 14 years old—the most up-to-date tonnage in the world in type, size, speed and equipment. This was shown by the fact that the British Mercantile Marine was responsible for over 50 per cent. of the world's sea-borne commerce. All nations were dependent on us. As a matter of fact, 30 per cent. of the trade between foreign countries was carried on in British bottoms, and the work of the British mercantile marine represented a cash value in invisible exports of something like £100,000,000 as a contribution to the national resources.

It may be asked how did we acquire such a mercantile marine? It was not accomplished in a day or a year, it was the slow growth of some 200 years of patient endeavor, and was the outcome of that spirit of adventure combining initiative, resource and courage which has built up the Empire. Shipowners, shipbuilders and engineers, animated by this spirit, took risks scarcely calculable, and in the end we had the greatest mercantile marine the world ever saw. It is true that our geographical position and our climatic conditions were the most favorable in the world for the building up of sea power, our natural resources and extensive sea board and the hardiness of our race, all combined to this end. From year to year our national sea traditions have grown from strength to strength, embodying the enterprise of shipowners, the skill of shipbuilders, and the courage of navigators.

It is the simple truth that the British Mercantile Marine has developed because of economic necessity, and that fact may well give us confidence when we are tempted to fear the friendly rivalry of competitors who have been actuated more by sentiment than national need.

What is our position today? During the war British tonnage decreased by 13½ per cent., but the actual reduction in the efficiency of our mercantile marine was a great deal more than the face value of this percentage figure. It is well known that our heaviest losses were amongst the largest and most up-to-date of our merchant fleet, and although the United Kingdom Steam tonnage is now over 19¼ million tons gross, some 400,000 tons gross more than it was in 1914, it is not nearly as efficient for transportation purposes as it was before the war. And I wish to emphasize the fact that whereas in 1914 the tonnage owned in this country represented 44½ per cent. of the world's total steam tonnage, it represents today less than 35½ per cent. of the world's tonnage. This, of course, is due in the main to the enormous expansion of the sea-going tonnage of the United States, which since 1914 has increased by nearly 10½ million tons gross or by 570 per cent. France has increased her mercantile marine by over a million tons gross, and Japan by nearly 1½ million tons gross.

Our merchant navy therefore is relatively much weaker than it was in 1914 to compete for the world's sea-borne commerce, and it behooves us seriously to consider this disquieting fact and set about regaining our old position. The importance of this to the population of this country cannot be over-estimated. The prosperity of all classes is involved in the maintenance of our merchant sea power, the development of the Empire as a world-force making for peace and justice is impossible without it.

And we must not lose sight of the fact that the war impressed on the other maritime nations the importance of merchant fleets, and they are making great efforts to establish large mercantile marines. Competition before the war was growing keener year by year, but it was comparatively small compared with the competition we shall have to face in the future. Japan in the East and the United States in the West are making strenuous efforts to retain some of the trades we lost to them during the war, and the friendly rivalry of these two Powers added to the competition of our European neighbors provides a task worthy of all our energies.

Speaking as a shipowner to shipbuilders, ship repairers and engineers I say deliberately that we cannot succeed without your help, and the assistance of the men employed in shipowning, shipbuilding, ship repairing and marine engineering. To a very large extent the future of our country and of our Empire lies in the hands of those who are engaged in these industries and the measure of courage with which employers and employed face the hard economic facts of world trade and world competition will be the measure of our success. It will be no easy task to make good, and this can only be done by united action and close co-operation between masters and men based upon an understanding of the true position.

Importance of Shipbuilding

I shall have something further to say on this subject later on; in the meantime, I desire to say a word or two about the history and present position of shipbuilding and marine engineering. Already we know enough to assert that shipbuilding is one of the oldest of human industries, and that there probably existed a sea-borne commerce in the Mediterranean long before the building of the Pyramids. The shipping industry ranks, after agriculture, as the largest of our national commercial pursuits. There is more capital stock locked up in it, and more people are employed in the navigation and construction of ships, their engines and fittings, than any other trade of the country excepting the tillage of the soil. Sometimes shipbuilding and marine engineering have been described as twin industries, but I prefer to consider them as one great industry. There ought to be no difference between shipbuilders, ship repairers and marine engineers. They should act together always in the best interests of their common object, the efficiency of the ships they manufacture and repair and the just treatment of their employees according to the conditions of the industry. I would even go further and urge that a yet closer association than exists at present should obtain between shipowners, shipbuilders, ship repairers and marine engineers—a combination not for any selfish, individual object, but for the furtherance of our national prosperity, and consequently the welfare of the community as a whole.

Before the war we were the greatest shipbuilding and marine engineering nation in the world; commensurate with the growth of our mercantile marine, and a vital factor in that growth was the growth of our shipbuilding industry. During the twenty years up to 1913, the world produced 25 million tons gross of steam tonnage, and the United Kingdom provided two-thirds of that. There was a progressive increase in output in the United Kingdom from 700,000 tons gross in 1894 to nearly two million tons gross in 1913, and 2,055,624 tons gross in 1920. In 1894 the output of British yards represented 81 per cent. of the world's output. In 1913 it represented 58 per cent. Other nations were beginning seriously to compete with us. In 1919 we only produced 22 per cent. of the world's output an in 1920, 35 per cent.

During the war the industry met every demand made upon it from the beginning to the end, whether for the Royal Naval Service or the merchant service, and in spite of all the stress and strain, the difficulties as regards supply of material and labor, we succeeded in building 3½ million tons gross of merchant tonnage in addition to the vast effort that was necessitated by the demands of the Royal Naval requirements.

But, just as in shipping, so in shipbuilding and ship repairing, we are faced today with foreign competition such as we never experienced before the war. The facilities in foreign maritime countries have been greatly extended as a result of the war. It was realized in these countries that a really efficient marine is impossible without an equally efficient shipbuilding industry. The inevitable result is that our shipbuilding supremacy is now seriously menaced, and we are faced with the necessity of producing the best quality ship in the quickest time and at the cheapest rate. This can only be done by a realization of the position by the employers and employed and by active co-operation of all concerned in the production of ships.

The Greatest Shipbuilding Nation

However, although the industry is threatened with serious competition, we may still claim to be the greatest shipbuilding nation. The facilities in our shipyards' and engine shops are greater to-day than they were before the war and the strength and ability of shipbuilders and marine engineers are unimpaired. The experience gained of war work and the careful study of design and method of manufacture have placed us in a relatively more efficient position today to organize production to the best advantage so as to obtain the maximum output at a reasonable price.

Unfortunately, both the shipping industry and the shipbuilding and marine engineering industry are in a most depressed condition. Ships are laid up, ships have largely ceased to be built, and thousands of men are unemployed. And the cause is not far to seek. Neither employers nor employed are wholly to be blamed. If blame in such a wholehearted fashion is to be borne at all, it must be borne by the community as a whole. For the depression is almost entirely the result of the war. Further, it is a world slump. Overseas trade is probably considerably less than half of what it was before the war. All countries are suffering alike from the general impoverishment due to the terrible waste of war. For a time after the war we enjoyed an artificial boom by an artificial inflation of values and forgot in the feverish excitement caused by this false prosperity and the natural reaction from the war, that, ultimately, the poverty induced by a long period of destruction could only be met by rigid economy and increased production. If we had only had the wisdom to act upon this fundamental truth we should have been in a much better position than we are today. But we sought higher profits and higher wages all round in face of decreased working hours and reduced output. Now there are no profits and little or no wages because work cannot be carried on. Customers cannot afford to pay the high cost of production and the demand has ceased. The value of the product is less than the cost of producing it.

The False Prophets

Our only light in the darkness—and it is not a very illuminating one—is that

other countries are apparently just as badly off as ourselves and we still have time in which to grasp the situation and to make the necessary readjustments in front of our competitors. To this end we must concentrate our minds and direct our energies, and I believe signs are not wanting that we are learning our lesson in the hard time of adversity which uneconomic conditions have brought upon us. To recover our equilibrium we need security and confidence. The war produced complete insecurity in all the ramifications of the political and industrial life of the nations, and we have not yet succeeded in re-establishing stable conditions. Out of the unrest in the world ill-balanced ideas born oftentimes in the brains of well-meaning but impractical idealists, were propagated with a fanaticism which was mistaken for knowledge and wisdom. Even in our own land we have been familiar with the preachings of principles and methods subversive of the common good and leading to disaster for all. The teaching of history was neglected, and although we have been saved from the worst effects of the teachings of these false prophets, yet we have not been untouched altogether by the mental confusion it produced while in other lands we see the result in political, social, and industrial ruin. They forgot the great fact of the economic unity of the world and ignored the laws which govern the common weal of nations.

Nothing but real peace will restore the security and the confidence we need. As one has pithily said—"There will be no peace of plenty until we have plenty of peace." And we can have no assurance of peace so long as the Governments of the world devote 20 per cent. of their expenditure to the maintenance of armaments, and preparations for war. To-day out of every pound that we pay in taxes more than 12s, is spent on old and new wars. Before the war the U. S. A., Great Britain, France, Italy and Belgium together spent on armaments 228 millions sterling. After the war—with an impoverished world—the same countries are spending 1,178 millions. Bankruptcy threatens most of the Governments of the world, and it can only be averted by stopping this mad competition in armaments.

Peace is the urgent political problem of the world. It is no less the urgent industrial problem. We used to talk during the war of saving the world for democracy. To-day we want to save democracy for the world, and it can only be done by industrial peace. Just as the revival of trade and the return of prosperity were hindered after the Napoleonic Wars, and again after the Franco-German War, by upheavals in the world of labor, so at the present time, our depression in trade has been accentuated, and remedies made abortive, by the vain ambitions of extremists ending in disputes between employers and employed, and between one section of workers and another section. Can anyone view with equanimity the loss sustained by these costly stoppages of work, a loss that falls upon the whole community! In 1920 twenty-seven million working days were lost in this way, and during the first six months of this year (1921) no less than seventy-seven million working days have been lost from the same causes. War between civilized nations is a mad and stupid thing. Strikes and lock-outs in the industrial world are just as mad and just as stupid. There is always a serious loss of wealth-producing power—a loss which falls primarily upon both employers and employed, and in the end on the nation at large.

Labor's Share

Much has been done in the past to prevent stoppages by regularized agreements between associations of employers and trade unions, and I look to an extension of such means of negotiation in the future. Confidence and consideration on both sides enable good relations to be established. These fundamentals can only result from a right understanding of each other's point of view, and this will come when both sides appreciate their mutual responsibility for the well-being of industry. The real interests of employers and employed are identical. They are both the servants of their common paymaster—the buyer. It is just as much to the advantage of the one as of the other that production should be increased to the utmost limit. We can only succeed in bringing prosperity to the people, in improving their standard of life, by becoming a productively efficient community. You cannot have a higher standard of life without earning it.

I sympathise thoroughly with the true aspirations of labor, but they can only be realized with the full co-operation of capital. And capital should be ready and willing to encourage that co-operation. As in the prevention of stoppages upon which I have just now touched, so in the realms of labor's true aspirations. Much has already been done but again much remains to be done. Employers no longer look upon those they employ as mere machines. I look back over the last hundred years which have seen the mighty industrial transformation of our land due to the advent of steam and, in the main, we were too busy with the development of industry to think adequately of the human element and to provide for it, and the later development of industry under the limited liability companies' acts has largely destroyed that personal interest which existed in the old days of private firms. During the last 25 years, however, that mistake has been gradulally rectified, and to-day there is full recognition of the necessity for the touch of real humanity in all our dealings.

I do not wonder, as I remember the history of our industrial development, that the workers look with suspicion on some of the attempts made by employers in these latter days to provide for the intellectual, social and physical needs of their workpeople. But great strides are being made in this direction and if slowly, none the less surely, will these attempts be assessed and welcomed by the workers as honest and righteous endeavours to provide for their whole life. Promising development along these lines is the formation, in 1916, of the National Alliance of Employers and Employed. This Alliance has established in thirty-seven industrial centres in the United Kingdom joint committees of the principal employers and the elected representatives of the Trade Unions of all industries in each centre. The members of these joint committees meet to take joint action for the benefit of industrial workers throughout the town or district, and to discuss, as practical men, how the welfare and the efficiency of industry, from the employers' point of view, as well as the workers,' can be promoted and secured.

The success and growth of this movement, which is entirely voluntary and in which employers and trade union delegates meet on equal terms, proves, I think, that a way is possible by which industry may again become a matter of partnership in the highest sense of that term. By bringing employers and Trade Unionists into intimate personal contact over matters equally interesting to both sides, it engenders a new spirit of comradeship, of conciliation, and a desire to do justice each to the other. If this spirit is allowed to grow up everywhere and permeate our industrial life: it will ultimately kill at the root the suspicion which becomes distrust, which breeds hostility and too often ends in strife.

An equally hopeful augury is the growth of what has come to be called "Welfare Work," especially when it deliberately includes direct educational facilities. It is comparatively a new thing in our industrial life, but it has a great future before it. It can, and I believe will, be an important factor in reconstructing the material, moral, and spiritual well-being of the people.

Education

I know that this Institution has ever taken a keen interest in education, especially in these technical matters belonging specially to shipbuilding and engineering. Your recommendations regarding the better education of apprentices were progressive and comprehensive. They provided for the whole life of the apprentice and nothing but good could result from their adoption in the widest possible way. Improvements in education are essential, but if merely confined to ensuring a better chance of material success in life they will not accomplish much that is important. Your scheme, I am glad to know, was broader based, providing for the developing of a civic conscience, of honesty, initiative, self-reliance, and a readiness to take responsibility. The idea ought to be that expressed in the words of Sir John Lubbock: "We advocate education not merely to make the man a better workman but the workman a better man—Yes, every man a better man."

My complaint about democracy is that it fails to face the economic basis of industry, it does not want to think things out to their logical conclusion, and as a consequence endeavors to escape every shadow of discipline and personal obligation, seeking only material enjoyment, the things of the body and ignoring the things of the spirit. This means a flattening down of life—a loss of the quickening of the individual brain and will; for it is the spirit that quickeneth a man throughout the whole realm of life, intellectually, socially, and industrially. We are all in danger of leaning on others instead of accepting with courage the responsibility of our own destinies; thinking of how much we can get of life either than of how much we can put into it—how much we can get from the community rather than how much we can give to the community.

Have you ever considered the growth of the cost of public assistance? In 1919, 28 million persons out of a population of about 48 millions received public assistance, and the cost of assisting this 58 per cent. of the population was £6-17s. 4d. per head of the population. Even if free education were excluded, the cost was £4 2s. 11d. per head of the population for assisting 46 per cent. of the population. The total sum drawn from taxes and rates for public assistance has grown by leaps and bounds until it has reached a staggering figure. May I give you four figures to indicate this growth?

1891 ....£25,000,000
1911..... ....£69,000,000
1919.... ....£173,000,000
1920..... ....£332,000,000

I venture to say that we cannot go on at this rate: I say further, we cannot continue to pay the colossal sums now provided unless we work more and produce more. Our commerce must expand or we shall be unable to bear the load o taxation laid upon industry.

I fear that I have wearied you, but I was sure of your sympathy and have thus unburdened myself of some of the thoughts which have been troubling me as a business man and as a lover of my country. The exaggerated hopes at the close of the war made us look for a new world and instead we find ourselves faced with crushing taxation, an alarming increase in the cost of living, widespread unemployment and industrial strife. We can only raise ourselves out of this valley of depression to the hills of prosperity by strict economy and the energetic co-operation of all classes. The ideal at which we should aim is that of a great commonwealth in which all citizens develop to the full their varying capacities and in which each willingly co-operates with his fellows. To make a better world we want better men and women who seek the great principles of justice, not simply between employer and employed but between man and man, and who strive for a policy, sane in its outlook, constructive in its working, and wide enough to include that great ideal of a better England to which, through blood and tears, through failures and mistakes innumerable, we are, I believe, moving slowly and painfully but nevertheless surely.

LAUNCH OF S.S. KUTSANG

On the 19th October there was launched from the Wallsend Shipyard of Messrs. Swan, Hunter & Wigham Richardson, Ltd., the Katsang, a single screw ship to carrry passengers and general cargo and to run in the service of the Indo-China Steam Navigation Co. of Hong Kong and London. Messrs. Swan, Hunter & Wigham Richardson have already built a number of ships for these owners. "Increase in Luck" is the meaning of Kutsang, which name was bestowed upon the ship by Mrs. Keswick, the wife of Major Henry Keswick of Cowhill Tower, Dumfries, as the vessel left the ways in the presence of a large company of visitors.

The Kutsang has an overall length of 434 feet, a moulded breadth of 54 feet, a depth of 31 feet, and will carry 7,000 tons deadweight on a draft of 25 1-2 feet. She has been built to Lloyd's highest class, and has a poop, a long bridge amidships, and a full topgallant fore-castle. On the boat deck there are comfortable quarters for the captain, a smoke room, and a ladies' room. On the bridge deck, on either side of the engine casing are cabins for the officers and engineers, and forward of the funnel are staterooms for first class passengers and the dining saloons. In the poop is accommodation for the second class passengers and above the steering-gear house is an hospital and dispensary. The sailors and firemen have their quarters in the forecastle, the petty officers and apprentice boys being housed on the upper deck on either side of the mail and baggage compartments beneath the first class dining saloon. Refrigerating machinery will be installed to keep meat and other perishable provisions in good condition.

In most of the cellular double bottom of the ship, oil fuel can be carried as well as water ballast. The machinery and boilers of the Kutsang have been built by the Wallsend Slipway & Engineering Co. The main engines are of the four-cylinder quadruple expansion type, balanced on the famous Yarrow, Schlick and Tweedy system. There are four single-ended, cylindrical boilers with a working pressure of 220 lbs per square inch under forced draft.

TIDAL RESEARCH WORK IN EASTERN CANADA

Have you ever had occasion to refer to tide table? Did it ever occur to you how this advance information is compiled?

The general public are unacquainted with the method of obtaining information concerning tides. The system of reducing the tidal observations is complicated and technical. The usefulness of the survey can, therefore, best be judged from the published results as shown in the annual tide tables issued by the Naval Department. These tide tables give the time of the rise and fall of the tide or the turn of currents along the Canadian coasts for periods of one year in advance; that is, the time of the tides for 1922 may be obtained from the tide tables issued in the fall of 1921. The tide tables also give for various regions the height of the tide and the depth over certain areas at high and low water. The information is valuable to shipping interests as they are enabled to know the depth of water over bars and shoals at the entrances of our harbors at any stated period. The information compiled by this survey is also useful with regard to mean sea level which is determined by them and which is used by land surveys as the basis of their levelling operations.

The record of tides is obtained by use of an ingenious instrument actuated by clockwork. This instrument gives a continuous curve which shows the height of the tide at every moment throughout the day and night, and thus records more accurate information than could be obtained by three men set to observe the tide in eight-hour shifts during the 24 hours of each day. These instruments, to give correct results, must be carefully installed and must also be kept accurately set.

The tidal records complied by the Canadian Government have now reached a high standard of perfection and Canada is well in the lead in recognizing the importance of tidal information not only for navigation purpose but also as a basis for carrying out levelling operations and survey work on land.

Extensive tidal research work has been carried on by the tidal survey branch of the Naval Department during the past summer. This work was performed in order to obtain additional tidal data over that compiled in previous years for our harbors and various other areas for which tidal information is required.

During the past year observations of the tide were made at Campbellton and Dalhousie at the head of Chaleurs Bay and other habors in eastern New Brunswick, where the tide is of special importance because of bars at their entrances. At these harbors, considerable dredging has been done, or is in prospect. Tidal data are essential in relation to low-water levels and the amount of rise of tide where the depth of water available for navigation is limited. The tidal data will facilitate the determination of what amount of dredging is necessary.

Three new tidal stations were put in operation at the entrance to the St. Lawrence, i.e., at Gaspe, Fox River and Seven Islands. Tidal data were also obtained for the east coast of Hudson Bay and for James Bay. In addition to the special work undertaken, the six permanent tide stations on the east coast have been continued and from the reduction of the records obtained will be compiled tide tables for future years.

THE NEW liner "Empress of Canada," which will be operated in the trans-Pacific service by the Canadian Pacific steamships Company, will be on her way to these waters late in February and will be placed in commission in the British Columbia-Oriental route by the last of April, according to J. J. Forster, general passenger agent of the company, who has just returned from a trip to the east. The "Empress of Canada," he says, exceeds everything in the way of steamships that have so far appeared on the Pacific. She developed a speed of 20.5 knots per hour. The "Empress of China," which will also be placed in the trans-Pacific run, is now being fitted out at Hamburg. Mr. Forster says it is uncertain what the company will do with the "Empress of Japan." The deal with the Pacific Steamship Company for the purchase of this craft has been definitely cancelled, because of United States coast steamship laws.

It is understood that the Simmons Construction Company, of Winnipeg, has been awarded the contract for building the new superstructure of the ocean docks at Prince Rupert.

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Effective with the sailing of the Japanese liner Tosa Maru for Victoria, November 11, the Nippon Yusen Kaisha, Japan's premier shipping company, will introduce a reduced scale of passenger rates for the trans-Pacific service. The amount of the cut amounts to roughly ten per cent. Single promenade cabins will be reduced from $375 to $345. Upper deck double cabins will drop from $300 to $270.

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British shipping interests are continuing investigations into North Pacific trade possibilities with a view to extending their services into these waters. The Furniss Withy Line is looking for business openings and if sufficient cargo is found to be offering, British Columbia ports will be included on the regular sailing itineraries of the company's steamships. At the present time the only vessels plying between Europe and British Columbia are those of the Harrison Direct Line. The French Line will probably establish connections in a few months, however, and another likely service to British Columbia is that of the Ellerman-Wilson Line. This line has already announced a service to Seattle. The Furness-Withy liner "Barrymore," the first of that company's fleet to be sent to the North Pacific to load freight, has been diverted to carry freight to the Far East for Waterhouse & Company.

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A. Borstedt, formerly general freight agent of the Canadian National Railways at Vancouver, has been appointed general traffic agent with headquarters at Shanghai, China. He will have general supervision of Canadian National affairs in China, Japan, the Straits Settlements and the Philippines.

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At the Vancouver sessions of the Pacific Coast Association of Port Authorities convention, Oakland, Cal., was selected as next year's meeting place, and the following officers were chosen: A. E. Carter, Oakland, president; Charles T. Howard, Oakland, secretary; Colonel G. H. Kirkpatrick, Vancouver, first vice-president; J. H. McCullum, San Francisco, second vice-president; J. H. Burgard, Portland, third vice-president; Rufus Choate, San Deigo, fourth vice-president. A resolution was passed urging the American and Canadian Governments to acquire and equip air bases for commercial and defence purposes on this coast.

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An agitation has been started in Victoria for reduction of the high charges levied by the Dominion Government for use of the drydock at Esquimalt. The Hawaiian-Australian liner steamship Arizonan recently ran aground on San Juan Island a few miles from Esquimalt and was towed to that port for survey. Tenders were called for. The ship repair firm of Yarrows, Ltd., at Esquimalt, recognizing that with the high government drydock charges to pay for accommodation, favorable competition with United States yards would be impossible. The Victorian Chamber of Commerce and other bodies made representations to the Dominion Government urging that for the purposes of the Arizonan contract and as a special measure for the relief of unemployment the fee should be abolished or at least reduced. It was pointed out that the government charge for drydock accomodation amounted to $800 a day, while American contractors, owning their own docks, could make a nominal charge for that service. The government, however, declined to make any reduction and the contract was lost. Efforts are being made now with a view to having drydock charges revised. Work on the new Esquimalt drydock which will be one of the largest in the world, is proceeding rapidly.

E. J. Coyle and associates, of Vancouver, have taken over the boats operated for the Westminster Towing and Fishing Company by George F. Mann and N. R. Preston. The tugs are the Faultless, Fearless, Peerless and Wireless.

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J. H. Pillsbury, it is understood, will be in charge of the Prince Rupert drydock when the Dominion Government takes over the control and operation. About one hundred workers will be retained in order that emergency repair work may be handled.

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No satisfactory offers having been received for the leasing of the Prince Rupert drydock and shipbuilding yards, the plant will revert to the successors of the Grand Trunk Pacific Railway. It is stated that the plant will continue to operate, as plans are under way for lines of work which hitherto have not been handled there. These include repair of railway stock.

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The Canadian Robert Dollar Company will operate a fourth steamer in the route between Vancouver and the Far East next year, according to announcement by A. Melville Dollar, managing the company's interest in British Columbia. This will provide a thirty-day service. Mr. Dollar has denied the report that the Dollar interests intend to transfer their headquarters from San Francisco to New York.

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The Department of Marine has called for tenders for the construction of a new ice-breaker, and British Columbia shipyards will bid on the job, filing their offers by November 15. Some time ago the department called for tenders, having been granted an appropriation of $2,000,000 for the work. Tenders were given, but owing to the high prices quoted the department deferred making an award, the lowest bid being something like $500,000 more than the appropriation. The lowest bid was from the Wallace shipyard & Drydock Company, of North Vancouver. Vickers, of Montreal, were second. It is understood that the Wallace and Coughlan firms in Vancouver and Yarrows at Victoria and Esquimalt will send in new tenders. The vessel is to be a fully equipped steel, twin-screw ship, 275 feet between perpendiculars, with a 57-foot beam and 19 foot draft, 32 foot draft, with engines capable of developing 8,000 horsepower.

The Trials Of The Motorship "Malia"

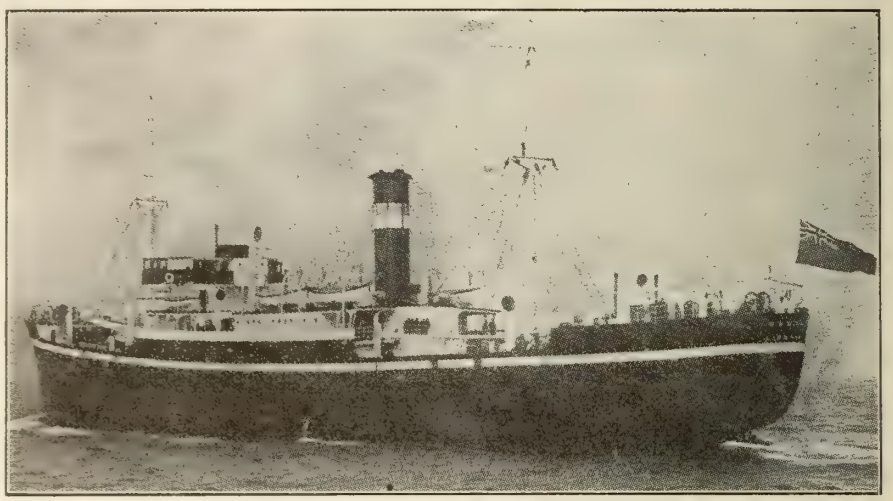
The First Ocean Going Motorship of the Anchor-Brocklebank Line is Fitted with Twin Motors of the Fullagar Type, Developed by Cammell-Laird's of Birkenhead, Combined H.P. 1570

TRIALS were run on the Clyde on September 29th and 30th of the twin-screw cargo motor-ship "Malia," built by William Hamilton & Co., Port-Glasgow, for T. & J. Brocklebank (Anchor-Brocklebank Line) Liverpool, which is notable as being the first ocean-going vessel fitted with Cammellaird-Fullagar internal-combustion engines as the main propelling power. A coastwise vessel — the all-welded-hull "Fullagar"—has already been tested with this type of machinery, but she was an experimental ship, both in hull and machinery, and her single-screw installation was found to be more powerful than was necessary as has been previously indicated in these pages. It will be remembered that it was removed and replaced by a set of Beardmore oil-engines. The original "Cammellaird-Fullagar" set now forms the port propelling-engine of the "Malia" while the star-board engine of that vessel has been constructed to the same design and of the same power, so that the "Malia" is a twin-screw ship of double the power of the "Fullagar." She is 365 feet in length over all, 350 feet between perpendiculars, 50 feet in breadth, 27 feet 3 inches in depth moulded, of 3,880 tons gross, and 6,000 tons dead-weight on a draught of 23 ft.

On the trials the combined indicated horsepower of the two engines when running at 1.5 R.P.M. was about 1,570, or 1,100 B.H.P. On the 29th the average revolutions of both engines was 118, giving an I.H.P. of 1,480, while the speed of the ship is 10.7 knots.

The fuel consumptions of these engines works out at 0.42 lb. per shaft h.p. hour or 0.29 lb. per I.H.P. The oil used was supplied by the Anglo-Mexican Petroleum Co., and is their standard Diesel fuel-oil having a specific gravity of 0.904. After the first trip or two practically any of the fuel-oils available will be used. The lubricating-oil consumption was 0.003 lb. per B.H.P. hour, which will be reduced as soon as the s arboard engine has run itself in.

A mean speed of 10 3-4 knots was attained at 116 R.P.M., or over a knot more than that which will be required on regular service, and 1,100 B.H.P. was developed. The fuel-consumption worked out at from 4 1-2 to 5 tons per 24 h urs, which at a price of £4.15s per ton, makes a total cost for the day's running of from £21 to £23, 15s ($84 to $95) as compared with an estimate of £34 for a coal-burning steamer of similar size and speed. To this must be added the very important facts of space saved by the abolition of boilers, water and bunkers, while it is estimated that, as compared with other internal-combustion installations now on service, there is a saving in fore-and-aft space of about 50 per cent. Therefore, it will be of interest if the builders publish the exact dimensions and weight.



The New Motor Ship "Malia"

The vessel carries a sufficient amount of fuel for the voyage from the United Kingdom to India and back. Oil-fuel is also used for a Vickers-Petters auxiliary engine, while a donkey-boiler supplies steam for the cargo winches. Each of the main propelling-engines weighs about 47 tons, and on the trials they worked with the slightest amount of vibration, and were almost noiseless in operation. The engines, as is well known, are of the four-cylinder, opposed-piston type, the cylinders being 14-inch in diameter and the stroke of each piston being 20-inch which means an actual stroke of 40-in.—The pressure was about 1,000 lb. per square inch.

There was on board a large number of engineers and others representing shipbuilding and engineering firms, and the opinion was expressed by all of them that the machinery installation was one of the most perfectly balanced of which they had ever had experience, and ran with remarkable smoothness and lack of vibration. In the reversing trials, it may be added, the vessel was put from full-speed ahead to full-speed astern in the short time of six seconds.

It is interesting to note that only two days were required to tune up the engines before commencing official trials, and it is therefore unlikely that Cammell Laird & Co. will go to the expense of running any more of this particular size of engine on the test-bed, but will follow the steam-engine practice and the practice of several other leading Diesel-engine builders, of installing them in the ship direct without official tests. The trial results of a similar engine have already been published and need not be repeated. It should, however, be stated that the second of the two engines for the "Malia" was run at a B. H. P. of 540 with a perfectly smokeless exhaust, and that, due to improvements in the ports, the scavenging-air pressure was reduced to the low figure of 1 lb. per square inch. The turning-gear for both engines is driven by one 4 B. H. P. English Electric Co., electric-motor with a cross-shaft and worm-gear.

The engines were built and the whole of the machinery installed under the supervision of Messrs. G. S. Goodwin & Co., of Liverpool.

An electric steering-gear of the Hele-Shaw type is fitted, enabling the donkey boiler to be completely closed-down when the ship is at sea.

It is the builders' practice to arrange for each engine to drive all pumps and auxiliaries necessary to make it a self-contained propelling unit, and the fuel-consumption of "Camellaird-Fullagar" engines hitherto published have been for such engines. In the present installation, however, for particular reasons of the owners, the oil and water circulating pumps are seperately driven. Seawater, freshwater circulating and lubricating oil-pumps have all been duplicated, each pump being of capacity enough to supply all necessary water or oil as the case may be for running both engines.

Two combined dynamo and air-compressor sets are installed, one on the port and the other on the starboard side of the engine-room. Each set is driven by a two-cylinder Vickers-Petter hot-bulb engine developing 78 B. H. P. at 300 R.P.M. Three small air-bottles are supplied with each set for starting pur-

poses. Each engine is direct coupled to a 45 K. W. Allen dynamo, and through a clutch to a Reavell 3-stage quadruplex air-compressor capable of pumping 124 cubic-feet of free air per minute to the bottle storage-pressure of 1,000 lbs. per square inch. Twelve air-bottles are fitted on the forward engine-room bulkhead for storage of the starting air.

An auxiliary air receiver of 30 cubic feet capacity, storing air at a pressure of 200 lbs. per square inch is fitted in the 'tween deck at the port side, for supplying air to the windlass, donkey-boiler feed pump, oil firing gear and ballast pump, when the donkey boiler is not in use or when steam is being raised. In addition to the main generators, an emergency lighting set is fitted on the port side at the main deck level. This is driven by a single-cylinder Vickers-Petters hot-bulb oil-engine developing 10 H.P. at 425 R.P.M. The Allen dynamo is of 5 K.W.

GOSSIP FROM THE B. C. COAST

Offerings of freight between British Columbia ports and California have shown a big increase during the last few months, with the result that the Kingsley Navigation Company is looking about for a third steamer to place on the same route. At present the Canadian line is operating a regular service with two vessels, the E. D. Kingsley and the Chilkoot, recently chartered from the Union Steamship Company, of Vancouver. A third vessel, the steam schooner San Antanio, was acquired from the Pan-American Line, of San Francisco, for one voyage when cargo shipments were exceptionally heavy.

* * *

British and Japanese shipping interests will be affected if the announced intentions of the Emergency Fleet Corporation respecting the port of Manila, Philippine Islands, are carried out. The corporation plans to include Manila in the coastwise trade routes, giving it the status of an American port as from February 21. In the event of this proposal materializing, trade between American ports and Manila will be placed on precisely the same basis as trade between any other American ports. Foreign ships are excluded from the coastwise trades routes.

* * *

Frank Young, representing the Canadian Government Mercantile Marine, has gone to Mexico to investigate the possibilities of developing coastwise trade between that country and Canadian ports. Pending submission of his report, the Government steamers will not go further south than California, except those plying in the Panama Canal service. B. C. Keeley, general agent for the line in British Columbia, says that a great many inquiries assuring him of shipments have been received from Mexico, and while he is confident that worth while trade connections can be made he is reluctant to initiate any new services until definite data have been collected.

News from Port of Sorel

THE "Louis Philippe" formerly the property of the Canada Steamship Lines, left Saturday, November 19th, for Sarnia, Ontario, where she will be used as a Ferry by the Sarnia Ferry Company.

The "Louis Philippe" is 162 feet long, 37 wide and 11 deep and has a tonnage of 600 gross tons. Her engine is a 58 h. p. fore and aft compound; boilers, marine return cylindrical return tubes, 12 ft. 6 in. diameter by 12 ft. 6 in. long. She is a screw propelled passenger vessel.

She leaves Sorel under the command of Capt. F. B. Ely; and her chief engineer is Mr. W. Ramsbottom.

The men who were sent down near L'Islet, below Quebec, to float the "Canadian Recruit" have returned to Sorel, the work having been abandoned for the time being. The season is now too far advanced for work of this kind but it is expected that in the spring, other means will be made use of to salvage this vessel.

Mr. Walter Hazlett, Superintendent of the Canada Steamship Lines, was in Sorel this week, in the interests of that Company.

Boilers from S.S. "Northland," which is being dismantled by the Sorel Mechanical Shops have been sold to the Geo. Hall Coal Company, to be used in Steam barges, also it is contemplated to use others in the Trawler "St.-Julien" owned by the Government. There are four more to be sold.

Buoys are being pulled out along the St. Lawrence River channel and replaced, in some cases, by wooden buoys. There arrived from Halifax, via the Q. M. & S. Ry., two carloads of these gas buoys, to be stored at Sorel for the winter.

TRIAL TRIP OF S. S. COOLANA

The fleet of the Melbourne Steamship Co. of Melbourne, Victoria, has just been augmented by the delivery of the Coolana, a fine steel single screw steamship for carrying general cargo, built at Southwick-on-Wear by Messrs. Swan, Hunter & Wigham Richardson, Ltd., who not so very long ago built at their Neptune Works, Newcastle-on-Tyne, other ships for these same owners, the most notable being the Dimboola, a passenger liner which proved to be a great success. The Coolana went to sea for her steam trials on the 21st October, the owners being represented by Mr. D. York Syme, one of their directors, and by Mr. C. Bryers of Eyres & Bryers, consulting engineers and naval architects of Sunderland, and the builders by Mr. C. S. Swan. On a long run north of the mouth of the River Tyne the ship developed a speed of over eleven knots. The triple expansion engines and boilers supplied by George Clark, Ltd., of the Southwick Engine Works, Sunderland, worked to the satisfaction of all concerned. As soon as the trial was over the ship left for her long voyage to Australia.

The chief dimensions of the Coolana are 285 feet in length between perpendiculars, an extreme breadth of 41 1-2 feet and a depth moulded to the upper deck of 22 1-2 feet. The ship has been built to Lloyd's highest class and will carry 3,560 tons deadweight on a draught of 19 1-2 feet. She has a straight stem, an eliptical stern, a poop, bridge, and full top-gallant forecastle. The deck house amidships contains accommodation for the captain, officers and engineers, as well as the officers' dining room. On the poop deck are the hospital, petty oficers' messroom and wash houses for the sailors and firemen. The crew is accommodated on the upper deck at the after end. Wireless telegraphy has been installed in the ship. On the bridge deck abaft of the engine space is an icehouse. The holds of the ship, both fore and aft, are served by powerful derricks worked by eight steam winches, which will ensure expeditious handling of cargo. Water ballast is carried in the fore and after peak tanks as well as in the cellular double bottom.

A GUIDE TO THE CANADIAN MARINE CERTIFICATE

(Continued from page 8)

this being the rivet strength. This is accounted for by the use of the constant .9. The relation 27/28 really works out to .964, and if we use this we find the rivet section comes out at 89.2 and the least percentage of joint is then at the outside row of rivets as before. This shows that where the joint is designed to give close relations between the two percentages, the calculation of the strengths must be carried closer than is necessary in cases where the difference between plate and rivet strength is considerable. For instance in stationary boilers, it is not unusual to find the rivet strength approaching 125 or 130 per cent, with the plate strength around 82 to 86 per cent.

In the case of a quadruple riveted double strap butt joint such as is shown in our illustration, but not very frequently encountered, the percentage of strength can be designed to come around 92 per cent. The number of rivets in the pitch in this case will be 8 in double shear and three in single shear, making 17 in all, thus bringing up the rivet strength, while the long pitch at the outside row, which is just twice what it is in the triple riveted joint, makes the plate strength greater.

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Waterways Scheme

We have from time to time commented on this proposition, and we are brought back to the subject by an editorial in a daily newspaper, which claims that the force of opinion of the twenty million people living on the shores of the Great Lakes will overcome all opposition to the scheme. It further says that nothing can prevent the St. Lawrence and the Great Lakes becoming the Mediterranean of America. We disagree with this view point. One of the things that will inevitably prevent the Great Lakes becoming the Mediterranean of America is the fact that for six months of the year they are useless for navigation purposes. Further, they will be approached not by a channel twenty odd miles across like the straits of Gibraltar, but by tortuous canals made more difficult by locks. Of the twenty million people mentioned the number living along the Canadian shore of the Lakes is a very minor part. As to the power question, we have had unfortunate examples of how far out estimates can be when a particular scheme is being pushed. The Chippawa development in Ontario that started out as a modest scheme to cost about $10,000,000 has now cost over $50,000,000 and the end is not yet. This question is not one for ill-informed politicians or boosters to settle, but requires the fullest and most painstaking investigation by experts. If it can be shown to be feasible beyond all doubt as a power proposition, then subject to suitable guarantees it may be gone on with. As far as navigation is concerned, we have very many doubts about ever seeing large ocean steamers docking at Port Arthur or Fort William, canals or no canals.

Armaments

Probably there is nothing going on in maritime circles all over the world that is causing the amount of interest that the Washington conference may claim. It is the first time in history that a naval holiday has been proposed where there was any possibility of it being carried out. It is a considerable number of years ago that Great Britain made her famous offer to Germany, which was at that time the only nation that showed any signs of seriously becoming a naval rival. This offer was turned down in a contemptuous manner by the naval advisers of the Kaiser, who were firmly obsessed with the idea that some day they could wipe out the British navy, and become the greatest naval power of the world. A lot of things have happened since then, among them being the disappearance of the German Navy, which no one laments. Another thing has happened, and that has been the new born ambition of the United States under Secretary of the Navy Daniels, to become the world's leading naval power. This resulted in the embarkation on a programme of naval construction running into many millions of dollars, and destined in the course of a very few years to place the U. S. at the head of the world as far as naval power was concerned, This programme was well under way when the Conference was called and Secretary Hughes made his dramatic announcement calling for the scrapping of all ships under construction and a ten year naval holiday. After the scrapping had been accomplished, it would leave the three greatest maritime powers, that is Great Britain, United States, and Japan in about the same relative position as far as capital ships were concerned as they now stand.

On the face of it, it looks like a grand idea, and one destined to save the overburdened taxpayers in all three countries a large amount of money. It was promptly accepted in principle by the delegates from both Britain and Japan, but when it comes to getting down to practical details there is not such complete unanimity. The United States wants to build and maintain huge undersea boats. Great Britain wants to have a larger number of the lighter type of craft for home and colonial defence purposes, but would abolish altogether the submarine. France wants to have as large a navy as Japan. Thus it would seem that the lion and the lamb are not quite ready to lie down together.

There is no nation on the face of the earth that has as good a claim to possession of predominance in naval power as Great Britain. She is not only an island country, depending on overseas trade for her very existence, but her lines of communication with the daughter nations dotted around the world is by the sea, and by the sea alone. The British navy has been employed from time immemorial in the safeguarding of the ships of every nation on the seas, in charting the unknown waters, in clearing out pirates, and in keeping the seas free. The United States, while having a long coast line, does not need a large navy for protective purposes. Her distance from all countries which might be inclined to act aggressively against her is the best safeguard she could have. A fleet cannot operate against a hostile coast line which is thousands of miles from its base, and the only possible source of such aggression is Japan, which most people are convinced has not, and never had any intention of attacking the U. S. This bogey has been invoked many times, but it is hard to think of any one could seriously believe it. It is conceivable that Japan might attack the Phillippines in the event of the United States and herself ever getting into hostilities, but it is quite possible that if Japan did so, and captured them, the U. S. would heave a sigh of relief.

It is to be hoped that out of the conference something may materialise to which all the interested nations can agree, and thus reduce the ever increasing burden. At the same time there is always the danger that the conference may produce more hard feelings than anything else. The layman can only watch and hope that the force of public opinion will be strong enough to influence those at the conference to do all that is in their power to provide relief, while adequately safeguarding the interests of the countries they represent.

News of the Shipping World

THE LATEST reports of world shipbuilding as disclosed in Lloyd's returns for the quarter ending September 30th do not give much food for consolation as regards conditions in general, or locally in particular. The figures show an actual decrease in the number and tonnage of vesse's under construction, compared to the previous quarter. There were a total of 700 vessels under construction in the United Kingdom, as against 789 during the previous quarter. However of the total tonnage under construction there are 731,000 tons on which work was suspended, and 457,000 tons the completion of which has been postponed. These two totals, amounting to 1,188,000 tons, must therefore be deducted from the total under construction, which makes this instead of 3,282,972 tons, only 2,-059,000. The tonnage commenced in this quarter only amounted to 51,343 tons, a decrease if 500,000 tons as compared with the quarter of 1920. The output of the number of sh'ps completed also shows a considerable falling off, so the industry as a whole, seems to be in a very poor shape. Leaving the U. K. and coming to the rest of the world, we find much the same state of affairs existing. The total tonnage building abroad that is outside of the U.K. is 2,260,006, but here again we find that these figures include about 375,000 tons upon which work has been suspended, so that the actual tonnage under construction is only 1,885,000. The two countries which have the most suspended tonnage outside of the U.K. are the U. S. and Italy. There are under construction 140 vessels, both steam and motor driven, and of a tonnage amounting to nearly 100,000, for the carriage of oil in bulk. Of this total 81 are building in the United Kingdom and 28 in the U. S. The total tonnage of motor vesse's under construction is 405,941. The construction proceeding in Canada at the end of Sept. is given as 20 steamers of 67,000 tons, and one motor vessel of 350 tons, besides 5 sailing vessels of 6,100 tons. Of this total, a large amount will be wiped off in the next quarters returns.

THE ACQUISITION of the plant "Majestic" by the fleet of the White Star Line has necessitated some changes in the staff, Commodore Sir Bertram Hayes of the "Olympic" having been appointed to the command of the "Majestic," and his place on the "Olympic" is being filled by Captain Hambleton. A third new vessel, the "Homeric" which will be on the Southampton-Cherbourg-New York service early in the spring will be commanded by Captain P. B. Howarth. All these officers have long held command in the White Star Line, and their records are of the best. Commodore Hayes needs no introduction to any sea faring audience, and the other two commanders, although not perhaps coming into the public eye so much as Sir Bertram, performed well and courageously their duties during the long war. The "Homeric" is said to the largest twin screw vessel afloat.

THOSE who doubted the ultimate success of the internal combustions engine as a motive power for ships, must be convinced at last. We are constantly hearing of large shipping firms being won over to the motor ship, one of the atest of these being the Lamport and Holt line, which have just had the motor ship "Leighton" built for them. Other noted lines which have acquired this type of vessel include the Royal Mail Steam Packet Co., the Brocklebank Line, and the Pacific Steamship Co. The Glen Line is a noted owner of motor ships, being one of the pioneers in this direction. They are trading upon every route, and can evidently be run at a profit in many cases where a steamer would show a loss.

THE long looked for improvement in the coal trade of the United Kingdom would seem definitely on the way, according to reports coming to hand during the past few weeks. There has been a great improvement in the enquiry from foreign buyers, and a number of orders taken that may lead to the opening up of some of the pits closed recently. It seems as though the foreign buyers, whose stocks are no doubt getting low, have decided that prices are as low as they are likely to be for some time, and they have at least got to a point where American coal cannot compete as it was doing during the stoppage of work in the British mines. There has been some attempt on the part of the miner's representatives to induce the Government to spend the whole of the £10,000,000 that was set aside to tide the industry over the period of wage reduction, but the Cabinet has very definitely assured the men that it has no intention of expending the whole amount. With the increased production and foreign markets opening up, there is every possibility that the coal trade will have got clear of its troubles before very long, and with an improvement in coal prices there should be a general improvement in industrial conditions in the U.K.

IT IS reported that the agreement which existed before the war between the German and British shipping companies trading to the far East, has been in part at least renewed. According to reports in the British shipping press, the Hamburg correspondent of the Deutsche Bergwerks Zeitung is the authority for the statement, and he is credited with being as a rule well informed. The contracting parties at present include the Hamburg-American and the North-German Lloyd on the German side, and the Bucknall Lines on the British side. The arrangement is for a joint service to the far East, all three companies placing their own vessels, and will start as a freight service with limited passenger accommodation. It is expected that the service will start with the beginning of the New Year, and that before long other large companies in both Britain and Germany will be included and Germany will be included in the conference. The renewal of the agreement between the British and German lines in the far East it is thought will effectually prevent any arrangement being made between German and American interests in this trade as has happened in the North Atlantic service.

THE statistical summary of vessels totally lost, broken up, condemned, &c., now published by Lloyd's Register, shows that, during 1920, the gross reduction in the effective mercantile marine of the world amounted to 585 vessels of 657,554 tons, excluding all vessels of less than 100 tons. Of this total 370 vessels of 518,959 tons were steamers, and 215 of 138,959 tons were sailing vessels. The statisticals tables exhibit interesting data as to the relative frequency of the different kinds of casualty, &c., which conclude the existence of vessel. Stranding and kindred casualties which are comprised under the term "wrecked" are the most prolific cause of disaster. To such casualties are attributed 45.6 per cent. of the losses of steamers, and 45.1 per cent. of sailing vesels. Cases of abandoned, foundered, and missing vesels are, no doubt, frequently more or less similar in the circumstances of loss. If these be taken collectively, they form over 29 per cent of the steamer and over 38½ per cent of sailing vessels removed from the Mercantile Marine during 1920, owing to casualty.

The amount of tonnage broken up, dismantled, &c., (not in consequence of casualty) in 1920 was only 11,951 tons.

The return has been prepared in such a manner as to enable a comparison to be made between the percentages of loss suffered by each of the principal merchant navies in the world. Great as the absolute annual loss of vessels belonging of the United Kingdom appears to be, it is seen to form but a very moderate percentage of the Mercantile Marine of the country, and to compare favourably with the losses sustained by the other principal Maritime countries.

Another result of poor freight markets which reacts to the benefit of the shipper is the practice of liners taking small parcels of goods for a rate much below the prevailing rate of bulk cargoes. They can do this because they have to maintain the service, and having the space available it pays them to make a rate that will be inducement to a shipper and whatever they get is in a way found money. An instance of this is given in the Liverpool Journal of Commerce, where pitchpine has been shipped from the Gulf to Holland and Belgium for $18 a standard, when the regular rate was just double that. The writer in the Journal, while admitting that the liners don't want to sail empty, deprecates the practice as giving the merchant and shipper the best of everything, and making a bad condition worse for the owner of the cargo carrier.

There has just been put into force an enormous increase in the pay of the officers of the German mercantile marine, but this increase is more spectacular than real. The new salaries show an increase of 1,200 per cent, over those in force in 1914, but the actual value of the money received is very small, due to the fall in value of the mark. Thus a chief officer gets a salary of 2,100 marks a month, which in actual money is worth about $15. While a second officer gets 1,500 marks, which are worth about $10. A chief engineer gets 2,475 marks a month while a fourth engineer gets 1,650 marks. These sums if the mark was at its pre-war value would make seafaring a populaar profession in the lte domain of the Kaiser, but at the present money value it must be pretty hard for a married man to make both ends meet. In addition to the scale of wages fixed there is an eight hour day for sailors, with a fixed rate of overtime for work performed out of the usual working hours.

"An interesting instance of the commercial usefulness of wireless telegraphy is afforded by a recent voyage of the motor ship "Seminole," which was twice diverted while en route by the use of wireless. She was bound for the Gulf of Mexico from Avonmouth, and her owners found it necessary to order her to Norfolk, Va., while she was still in mid-Atlantic. This was done by wireless, but on the following day, circumstances arose which made it necessary for her to be sent to New York direct. Although she was at that time over 2,000 miles from the English coast, the wireles station at Poldhu, Cornwall, had no difficulty in picking her up, and the necessary orders were transmitted. The saving effected by this means of communication can easily be realised. Several days were cut off the voyage, besides the various port charges which would have been incurred in going into the Gulf port, and thence to New York. This is a phase of wireless communication which while having nothing spectacular about it, results in the saving of thousands of dollars in money and time.

Countries which go in for prohibition of alcoholic liquors seem to have the same difficulty in enforcing it, no matter where they be. Norway has just passed a bill through both her houses of Parliament extending the limit of her territorial waters from three to ten miles from the shore, for customs purposes. This has been made necessary by the constant smuggling of alcoholic liquors, which are brought from Germany and other places where liquor has not yet been banned to just outside the three mile limit where it is transhipped into motor boats, and speedily reaches the thirsty souls ashore. Some of the chases arising out of this practice between the customs authorities and the smugglers have been so exciting that films have been made of them, which have been exhibited in the picture shows in Norway. It is a source of constant wonder to the man who sees no terrible crime in having a drink of wholesome liquor when he has the mind to, where the enormous demand for liquor comes from in countries the majority of whose inhabitants are in favor of laws, and have presumably been instrumental in passing laws, to abolish it. Even that holiest of provinces, Ontario, finds considerable difficulty in preventing people who badly need it from getting a drink, in spite of the vicious punishments inflicted on those who are caught.

That stainless steel can be used for other purposes than domestic cutlery has been well indicated as the result of experiments carried out on its use as turbine blades It had already been used in the making of piston rods, impeller shafts, tools of various kinds, and scientific instruments. It was felt that it would make a very desirable metal to use as turbine blading, and Messrs. Thos. Firth & Sons, of Sheffield the originators of the metal, fitted a number of blades in a Westinghouse turbine in their own power house. After running for about one year the turbine was opened up, and it was found that the blades made of stainless steel were in a much better condition as regards corrosion and erosion than the ordinary nickel steel blades which were fitted alongside of them for purposes of comparison. Another experiment made by the same firm was the fitting of a stainless steel ram to a hydraulic pump, along with two others made of the standard non-ferrous alloy. After a protracted period working night and day the stainless steel ram had worn only one sixty-fourth of an inch on the diameter, while the other two rams had worn seven sixty-fourths. These two examples show that there is a great field for the new metal in purely engineering services.

NEW CUNARDER "ANDANIA"

Recently a native of Newcastle expressed himself as follows: "The Tyne is fair cluttered up with Cunarders." The gigantice "Berengaria," (which was formerly the "Imperator,") the "Mauretania," (the fastest Atlantic liner,") and the newly launched "Andania" are there at present. The latter steamer was launched on November 1st. The two first mentioned steamers are at Newcastle to be fitted out for oil burning. The new ship, which is intended solely for the Cunard Canadian service, will be an oil burner from the start. Lady Perley, wife of Sir George Perley, Canadian High Commissioner, sponsored the new ship, which is a product of the yards of Mesrs. Hawthorne, Leslie & Co., at Hebburn-on-Tyne.

The new vessel is the first one built by Mesrs. Hawthorne, Leslie & Co., for the Cunard Line. She is 540 feet long, 65 feet beam, 43 feet in depth, 14,000 tons with a speed of 15 knots. She is fitted to take care of 500 cabin passengers and 1,200 third class passengers. She is, by the way, the seventh of the new Cunard ships on the list of the Cunard post-war building programme. The first two on this programme, the "Scythia" and the "Albania" are already in commission. The "Andania" is one of the six designed to carry only cabin and third class passengers. It is expected that the ship will be in commission early in the spring.

The ship is driven by steam turbines of the Parsons type and these turbines will be fitted with double reduction gears. The ship will have twin screws. Although fitted out as an oil burner provision has been made for fitting coal burning furnace mountings.

The cargo space will accommodate some 10,500 tons. These ships will sail direct to Quebec.

The Cunard Line now boast of an All-Red service between Europe, the United States, Canada, India, Australia, and New Zealand. They and their allied lines, control nearly a million tons of shipping. The company is easily one of the foremost British shipping companies and it may be noted that the ship "Berengaria," of 52,000 tons, is the largest vessel flying the red ensign.

Amherstburg:—The steamer "Hydrus" while coming up the river, blew out a cylinder head. Fortunately no one was injured. The vessel which belongs to the Interlake Line, is anchored awaiting orders.

Port Arthur:—The steamer "Bayton" formerly the "Frances Widlar," had an unpleasant experience while going from Port Arthur to Fort William a distance of only eight miles. She had left her whistle in the shop for repairs, and after leaving Port Arthur ran into a heavy snow and windstorm, with the result that she was groping about the lake for twelve hours before she finally found her way into Fort William. She was in constant danger, not having any means of signalling, of being run down by the numerous craft that were also nosing their way into either Port Arthur or Fort William in the storm.

LLOYD'S REGISTER SHIPBUILDING RETURNS

Quarter Ending September 30th

We publish herewith Lloyd's Register shipbuilding returns for the quarter ended Sept. 30, 1921. The merchant tonnage returned as under construction in the United Kingdom at the end of September, 1921, amounts to 3,282,972 tons. This represents a reduction of about 247,000 tons as compared with the total at the end of the previous quarter, but under the present conditions the figures can only be regarded to a large extent as nominal. As in the previous quarter, the total includes a considerable amount of tonnage on which work has been suspended owing to the decline in the demand for tonnage, and also a large quantity of tonnage the completion of which has been postponed owing to abnormal causes. The tonnage on which work has been suspended amounts to 731,000 tons, and the tonnage which has been delayed in completion amounts to about 457,000 tons. These two totals, amounting to 1,188,000 tons (equal to 36 per cent. of the whole tonnage under construction), must be deducted in order to enable a comparison to be made with the figures for normal times, and a reduced total of 2,095,000 tons under construction in the United Kingdom is thus arrived at. As compared with the figures for the quarter ended June 30, 1921, there has been a reduction of about 14,000 tons in the tonnage launched during the past quarter.

Attention was called in recent Quarterly Returns to the fact that, although the total tonnage returned as under construction was so large, the amount completed compared very unfavourably with pre-war times. In 1913 the average tonnage completed during each quarter was over 23 per cent. of the total work in hand at the beginning of the quarter. The corresponding figures for 1920 fell below 13 per cent. There is still a further reduction during 1921, the average output for the first three quarters having fallen as low as 8½ per cent. There is a continued reduction in the tonnage commenced. In the March quarter the decrease amounted to of 324,000 tons, and for the quarter under review the tonnage commenced only amounted to 51,343 tons, or a decrease of 455,000 tons as compared with the last quarter of 1920. This is, perhaps, the most significant figure in the return as indicating the very unfavourable outlook for the immediate future.

The total merchant tonnage building abroad is 2,260,006 tons, but this includes about 375,000 tons (equal to 16.6 per cent. of the total) upon which work has been suspended, leaving 1,885,000 tons actually under construction. The countries where the largest amount of work is suspended are Italy and the United States.

It will be seen that the tonnage is about 409,000 tons lower than the total building at the end of June, 1921, largely due to the continued decrease in the United States of America, in which country the tonnage now under construction is less than 10.5 per cent. of the total building there in March, 1919. Apart from the United States, the leading countries abroad are:—Italy, with 397,544 tons; France 350,681 tons; Holland 349,122 tons; and Japan, 186,782 tons. The total for Italy shows an increase of about 87,000 tons as compared with the previous quarter, but, as stated above, the total includes a very considerable tonnage on which work is now suspended.

The returns show that there are at the present time 140 steamers and motor vessels, each of over 1,000 tons, with a total tonnage of 931,813 tons, under construction in the world for the carriage of oil in bulk. Of the total, 81, of 527,791 tons, are under construction in the United Kingdom, and 28, of 222,292 tons, in the United States. The tonnage of vessels under construction which are to be be fitted with internal-combustion engines amounts to 405,941 tons. The tonnage being built in the world at the end of September under the inspection of the Surveyors of Lloyd's Register, excluding vessels the construction of which has not actually been commenced, and excluding all vessels of less than 100 tons, amounts to 3,785,550 tons.

Merchant Vessels Under Construction

The Returns compiled by Lloyd's Register of Shipping, which only take into account vessels of 100 tons gross and upwards the construction of which has actually been commenced, show that there were **700 merchant vessels of 3,282,972 tons gross** under construction in the **United Kingdom** at the close of the quarter ended Sept. 30, 1921. The particulars of the vessels in question are as follows, similar details being given for the preceding quarter for the purpose of comparison:—

Description	Sept. 30, 1921 No.	Sept. 30, 1921 Gross tns	June 30, 1921 No.	June 30, 1921 Gross tns
Steam—				
Steel	630	3,047,964	711	3,282,738
Ferro-Concrete	..	.....	..	.....
Wood and Composite	3	1,912	4	2,174
Total	633	3,049,876	715	3,284,912
Motor—				
Steel	49	229,120	54	240,198
Ferro-Concrete	..	.....	2	600
Wood and Composite	1	205	1	205
Total	50	229,325	57	241,003
Sail—				
Steel	16	3,471	16	3,832
Ferro-Concrete	..	.....	..	.....
Wood and Composite	1	300	1	300
Total	17	3,771	17	4,132
Total Steam, Motor and Sail	700	3,282,972	789	3,530,047

The tonnage now under construction in the United Kingdom is about 247,000 tons less than that which was in hand at the end of last quarter, and about 448,000 tons less than the tonnage building 12 months ago.

These figures, however, do not represent the work actually in progress. The total now returned as under construction includes 731,000 tons on which work has been suspended. It also includes 457,000 tons the completion of which has been postponed owing to abnormal causes. These two totals, amounting to 1,188,000 tons, must therefore be deducted from the tonnage under construction, for the purpose of comparison with normal figures, thus reducing it to 2,095,000 tons.

The September figures include 81 steamers and motor vessels of 1,000 tons and above, with a total tonnage of 527,791 tons, intended to carry oil in bulk.

Of the merchant vessels being built in the United Kingdom at the end of September, 570, of 2,673,762 tons, are under the inspection of the Surveyors of Lloyd's Register with a view to classification by this society.

Merchant Vessels Under Construction In the World

Where building		No.	Gross tons
United Kingdom	†	633	3,049,876
	‡	50	229,325
	§	17	3,771
*Other Countries	†	554	2,032,983
	‡	104	176,616
	§	117	50,407
Total for the World	†1,187		5,082,859
	‡	154	405,941
	§	134	54,178

*Excluding Germany, figures for which country are not yet available.

† Steam. ‡ Motor. § Sail.

The tonnage being built in the world at the end of September under the inspection of the Surveyors of Lloyd's Register, excluding vessels the construction of which has not actually been commenced and excluding all vessels of less than 100 tons, amounts to 3,785,550 tons.

Work in Hand in Principal Districts

The following table gives the total figures for vessels now under construction in the principal shipbuilding districts of the country, as compared with those for the last quarter. Each district of course includes places in the neighbourhood of the port after which it is named.

District		Sept. 30, 1921 No.	Sept. 30, 1921 Gross Tonnage	June 30, 1921 No.	June 30, 1921 Gross Tonnage
Aberdeen	*	12	15,420	18	18,605
	†	—	—	—	—
Total		12	15,420	18	18,605
Barrow, Maryport and Workington.	*	8	80,793	8	80,793
	†	3	20,667	4	27,556
Total		11	101,460	12	108,349
Belfast	*	40	349,600	41	352,550
	†	—	—	1	3,600
	‡	—	—	—	—
Total		40	349,600	42	356,150
Clyde—Glasgow	*149		783,827	158	813,794
	†	21	138,585	22	138,930
	‡	6	1,514	4	1,074
Total		176	923,926	184	953,798
Clyde—Greenock	*	47	250,264	49	257,930
	†	5	34,972	5	34,700
	‡	—	—	—	—
Total		52	285,236	54	292,530
Dublin	*	8	11,840	11	13,245
Dundee	*	20	61,800	24	78,240
	†	3	8,300	2	600
Total		23	70,100	26	78,840

H...	* 18	89,880	18	89,965
H...	* 29	60,296	28	68,187
	† 1	227	1	227
Total	20	60,523	29	68,414
Leith	* 10	28,653	16	46,713
	† —	——	1	3,845
Total	10	28,653	17	50,558
Liverpool	* 38	111,280	44	114,057
	† 2	268	4	868
	‡ 1	107	—	——
Total	41	111,655	48	114,925
Londonderry	* 3	17,800	4	24,800
Middlesbro', Stock- ton and Whitby	* 36	190,018	43	213,258
	† —			
Total	36	190,018	43	213,258
Newcastle	* 97	595,163	111	667,453
	† 4	7,631	5	12,081
	‡ 1	400	2	800
[illegible]	102	603,194	118	680,334
Newport, Mon. ...	* 6	18,546	5	17,346
	‡ —	——	2	458
Total	6	18,546	7	17,804
Southampton	* 23	56,679	25	59,541
	† 5	1,625	6	1,968
	‡ 1	250	—	——
Total	29	58,554	31	61,509
Sunderland	* 57	280,936	63	318,148
	† 2	10,340	2	10,340
Total	59	291,276	65	328,488

* Steam. † Motor. ‡ Sail.

The three tables which follow give further details of the work in United Kingdom yards; the fourth presents statistics of work abroad. In connection with the latter, it is of interest to note that at the end of September there were under construction abroad 59 steamers and motor vessels of 1,000 tons and above, with a total tonnage of 404,022 tons, intended to carry oil in bulk. Of these vessels 28, of 222,292 tons, were building in the United States of America; 9, of 64,180 tons, in France; and 9, of 52,500 tons, in Italy.

Vessels Under Construction for Abroad

Country for which intended.	No.	Gross Tons
United Kingdom	485	2,290,103
Argentine	6	8,800
British Dominions	23	82,815
Belgium	4	11,260
Chili	4	18,800
Denmark	5	19,840
France	41	223,181
Greece	4	18,920
Holland	25	211,914
Italy	3	53,000
Japan	4	25,200
Norway	35	112,814
[illegible]	1	1,200
[illegible]	1	200
Roumania	1	3,550
Spain	9	27,460
Sweden	1	5,170
United States	3	24,400
For Sale or Flag not stated....	44	144,345
[illegible]	760	3,282,972

Other Details

The following details concerning the shipbuilding work of the United Kingdom during the past three months may be added:—

During Quarter ended Sept. 30, 1921		No.	Gross Tons
[illegible]	*	13	12,433
	†	1	7,700
	‡	5	1,210
[illegible]	*	72	272,573
	†	7	32,620
	‡	7	1,657

* Steam. † Motor. ‡ Sail.

Size of Vessels Under Construction

The following table shows the vessels under construction in the United Kingdom classified according to gross tonnage:—

Gross Tonnage			Number Steam	Motor	Sail
*100 and under	500	.....	65	12	17
500	"	1,000.....	79	1	—
1,000	"	2,000.....	71	6	—
2,000	"	3,000.....	52	1	—
3,000	"	4,000.....	50	1	—
4,000	"	5,000.....	37	1	—
5,000	"	6,000.....	74	4	—
6,000	"	8,000.....	99	16	—
8,000	"	10,000.....	44	8	—
10,000	"	12,000.....	7	—	—
12,000	"	15,000.....	25	—	—
15,000	"	20,000.....	24	—	—
20,000	"	25,000.....	5	—	—
25,000	"	30,000.....	1	—	—
30,000	"	40,000.....	-	-	—
40,000 tons and above.....			-	—	—
Total			633	50	17

* Vessels of less than 100 tons are not included in Lloyd's Register Shipbuilding Returns.

Merchant Vessels Under Construction Abroad

Countries	Steamers and Motor Vessels: Steel No.	Steel Gross Tons	Wood No.	Wood Gross Tons	Sailing Vessels: Steel No.	Steel Gross Tons	Wood No.	Wood Gross Tons	Total No.	Total Gross Tons
America—										
United States—										
Atlantic Coast .	46	330,082	..	....	2	1,600	4	6,800		
Gulf Ports	7	27,680	..	....	..	....	..	....		
Pacific Coast ..	9	65,600	1	2,200	..	....	..	....	69	433,962
Great Lakes ...	..	.....	..	....	..	....	..	....		
British Dominions										
Canada—										
Great Lakes .	..	.....	..	....	..	....	..	....		
Coast	20	67,255	1	140	2	1,720	3	4,380		
									54	144,460
Australia	10	21,600	..	....	..	....	2	3,580		
Hong Kong	10	41,932	..	....	..	....	..	....		
Others	4	3,528	..	....	..	....	2	325		
Belgium	9	25,335	..	....	..	....	..	....	9	25,335
Brazil	1	2,170	..	....	..	....	..	....	1	2,170
China	6	15,505	..	....	..	....	..	....	6	15,505
Denmark	36	81,583	1	450	1	200	..	....	38	82,233
Esthonia	3	1,350	5	940	..	....	15	4,720	23	7,010
Finland	7	5,819	4	1,305	..	....	3	980	14	8,104
France	83	347,501	1	180	3	3,000	..	....	87	350,681
Greece	..	.....	1	600	..	....	..	....	1	600
Holland	137	347,472	..	....	6	1,650	..	....	143	349,122
Italy	74	379,302	28	10,620	..	....	31	7,622	133	397,544
Japan	46	186,782	..	....	..	....	..	....	46	186,782
Norway	45	75,493	6	1,371	2	475	..	....	53	77,339
Portugal	..	.....	10	6,223	..	....	33	11,273	43	17,496
Spain	16	74,867	..	....	..	....	1	150	17	75,017
Sweden	29	84,034	2	680	1	661	6	1,271	38	86,646
Total	598	2,184,890*	60	24,709	17	9,306†	100	41,101	775	2,260,006

* Including 3 ferro-concrete vessels of 4,475 tons and 1 ferro-concrete vessel of 2,000 tons.
† Including 3 ferro-concrete vessels of 3,000 tons.

The total tonnage building abroad includes 375,000 tons upon which work is now suspended, the countries mostly affected being Italy and the United States.

S.S. SERVICE TO BRITISH WEST INDIES

The Canadian Government is inviting tenders for a mail, passenger, and freight service between Canada, the British West Indies, and British Guiana. These tenders will be received at the office of the Deputy Minister of Trade, Ottawa, up to January 31st, 1922.

Tenders should be for weekly or fortnightly sailings from St. John, N. B., or Halifax, N.S., to the Bermudas, Barbadoes, Trinidad, and British Guiana, with calls at Grenada, St. Vincent, St. Lucia, and other places. Tenders also have the option of tendering for a weekly service with sailings alternately from St. John and Halifax. The length of time that the contract is expected to cover is from five to ten years. The steamers are to be from 5,000 tons to 6,000 tons gross, and must be able to maintain a speed of twelve knots an hour, provide accommodation for 100 first class, 30 second class, and 100 steerage passengers. In tendering it is requested that the amount of the subsidy required be stated. Other regulations state that there must be no unfair differentiation of rates of freight against the smaller as compared with the larger colonies, an that all freight and passenger rates are to be subject to the approval of the Minister of Trade. In addition, so far as the traffic warrants, cold storage must be provided. The steamers are to carry such mails as the Canadian or West Indian Governments may require.

RESULT OF RADIO EXAMS.

The Department of the Naval Service announces that fourteen (14) candidates were examined during the month of October, 1921, of which the following were successful and obtained certificate of proficiency in radio-telegraphy:

1st Class

Anderson, John, Montreal, P.Q.
Foster, R. McA., Westmount, P.Q.
McNeil, F. F., Prince Edward Island.

2nd Class

Webb, Rodney, Verdun, P.Q.

St. John:—The tug Lord Beattie owned by Nagle and Wigmore of St. John, N. B., was totally destroyed by fire at her home port on Saturday night November 5th. The hull now lies in the McAvity slip. The tug was valued at $30,000.00 and was insured for $15,000.00.

What Should The Safety Valve Area Be?

The Writer of This Article Shows What a Great Discrepancy There Is Between the Various Rules in Use and Shows That Practically None of Them Give Sufficient Relieving Capacity

By J. A. McGillivray.

WHAT should be the area of the safety valve? Where is the engineer who has not at one time or other had to answer this question? No doubt he worked it out by some recognized rule or formula. His answer was possibly correct according to the "Rule" adopted by the examining board of his district, state or port, or wherever he was located at the time. But this is where the trouble comes in. There are "Rules" and "Rules," "Formulas" and "Formulas." Why so?

There shouldn't be any disagreement about a good safety valve rule. Yet there are no two that agree with actual tests carried out in this country during the last few years. There are about twenty different safety valve formulas in use on the American continent. Will somebody get up in the Meeting and tell the World what is the meaning of the question anyway, if one man can settle it one way and another a different way and both be right?

Well, some may say those rules "must be right" as there are very few explosions traceable to insufficient safety valve capacity. That so? Do you know why? Isn't it because the safety valve is rarely if ever called upon to do that which it is supposed to do, i. e. to relieve all the steam that can be generated by the boiler when forced to the utmost. When the foreman knows that the load is coming off he checks the fires. There is on one mad enough to force the fires after the safety valves lift. So it may be that in view of the circumstances that the question of a few thousand pounds relieving capacity one way or another does not greatly matter. Well if so, why bother the engineer about it so long as there is a safety valve on the boiler, let it go at that. That is what it amounts to any how and all it will amount to until there is some agreement about rules for boiler construction and boiler safety. But for the present let us consider a given boiler under actual conditions as they came to the writer's notice and we will assume for the sake of argument that some day the safety valve will be called upon to do what it is supposed to do, i.e., relieve all the steam that can be generated by the boiler when forced to the limit under certain conditions of draft, fuel and pressure, etc.

Now I will take for example a boiler upon which I made an evaporation test, some years ago. A boiler which is typical of the modern installation in stationary plants in the United States and Canada and which is insured by a well known insurance company, having two (2) 4½" spring pop safety valves.

The test was run for ten hours, the boiler equipped with a chair grate stoker. During the afternoon we got the furnace temperature pretty high. At one time, during the best hour, the temperature of the furnace was 2470 deg. F.

I have the data for that hour as follows:

Boiler Data.

Com. Rating 600 H. P., Superheat 100 deg. Working press 200.

Water heating surface, 6000 sq. ft.

Grate surface, 110 sq. ft.

$$\left(\frac{H\ S}{G\ S}\right) = 54.54.$$

Test Data

Ave. steam pressure=185 gauge.

Ave. F. W. Temp.=40 deg. F.

Ave. superheat=100 deg. F.

Wt. coal fired=3740 lbs.

Wt. water fed=30,600 lbs.

Factor of evap.=1.3.

Eq. water (F. & A. 212)=39,780 lbs.

H.P. developed=1153=192% comm. rating.

Coal per sq. ft. G.S.=34 lbs.

Water per sq. ft. H.S.=6.63 lbs.

Eq. water evap. per lb. coal=10.63 lbs.

Eff. B.F. & G.=74%.

Heat value of coal used=14229 B.T.U. per lb.

Ave. draft=

$$\frac{42}{100} \text{ inches of water.}$$

The factor of evap. (1.3) is based on Superheated steam at (100°) since the amount of superheating has nothing to do with the safety valve capacity we will have to change the test figures, using the factor for saturated under the test conditions, or feed water at 40° into steam at 195 factor = 1.22.

Then the test becomes

Eq. water evap. from 212 deg. into saturated steam at 212=(30600x1.22)=37332 lbs.

H.P. developed=1080 H.P.

Water per sq. ft. H.S.=6.222.

Eq. evap. per lb. coal=9.98.

Eff. B.F. & G.=68%.

Under everyday operating conditions the feed water temperature is 180 deg. to 200. (Ave. temp. 190 deg.). And when operating at 200 lbs. pressure(the popping point) with an average feed temperature of 190 deg. F. and the same heat transference eff. the amount of water that would be evaporated with such a fire and consequently the weight of steam to be relieved by the safety valve would be equal to the weight of water evaporated into saturated steam on test (30600 lbs.) multiplied by the total heat (H) above the feed temperature per lb. transferred at test, divided by the total heat (H) above the feed (190 deg.) at 200 lbs. pressure.

Under test conditions, total water=30600 lbs.

Under test conditions (H+L)=

$$[(354.9—8) + (843.2)]$$

=1190.1 B.T.U. per lb.

Total heat transferred to the water=(1190.1 x 30600) with feed at 190° and steam pressure at 200 gauge, H + L = H =

$$[(361.4—158) + (837.9)]$$

=1041.3 B.T.U. per lb. required to evaporate the water into steam.

The total evaporation per hour under working conditions as already stated would be

$$\frac{30600 \times 1190.1}{1041.3} = 38700 \text{ lbs. per hour}$$

to be relieved by the safety valve and this may not have been the limit although I am quite sure it was without an increase of draft. Now these are not supposed conditions but actually existed and might exist again.

Two 4½ spring pop valves having a lift of 1-10 in. would not relieve this weight of steam per hour were they called upon to do so, as we can see by a reference to the table given herewith, as compiled by the Consolidated Safety Valve Company, from actual tests of stationary type spring pops having a lift of 1-10 in.

By reference to the table we find the relieving capacity of a 4½ in. spring pop to be 15,200 lbs. per hour at 200 lbs. gauge. Two of those will relieve 30,400 lbs. per hour or 15% less than the amount that the boiler would generate. Moreover it should be remembered that the average lift is not 1-10 or an inch, the lift of stationary pop safety valves varies from 0.031 to 0.137 with the average at 0.79.

Napiers Formula for the flow of steam air or any gas through an orifice is into some other pressure less than 5-8 of the initial is

$$E = \frac{3600\ A.P.}{70}$$

Where E=wt. discharged per hour.

Where A=the area of the orifice in sq. inches.

Where P=the absolute pressure lbs. per sq. inch.

Size of Valve in inches	GAUGE PRESSURES (LBS. PER SQ. IN.)												
	60	80	100	120	140	160	180	200	220	240	260	280	300
2"	1870	2400	2900	3410	3900	4410	4910	5420	5920	6430	6930	7430	8040
2½	2360	3000	3620	4250	4880	5500	6140	6760	7400	8030	8650	9300	9900
3	3070	3870	4700	5530	6350	7170	8000	8800	9620	10400	11200	12000	12900
3½	3960	4900	5910	6950	7960	9020	10000	11100	12100	13100	14200	15200	16300
4	4910	5510	6770	7950	9120	10300	11500	12600	13700	15000	16200	17300	18500
4½	5310	6700	8150	9570	11000	12400	13800	15200	16400	18100	19500	20900	22400
5	6300	7970	9650	11330	13000	14700	16400	18100	19700	21400	23100	24600	26500

This expression must be multiplied by a co-efficient depending upon the conditions. This co-efficient differs with some authorities. Gebhardts give the co-efficient for safety valves blowing into atmosphere as 0.96, while Babcock & Wilcox use a co-efficient of 0.93 and the Consolidated Valve Company 0.925. The last two being in pretty close agreement and most likely to be substantiated by recent experiments should recommend themselves to general use. Taking the lowest co-efficient since it is better to err on the safe side, where K—co-efficient=0.925, the expression then becomes

$$E = \frac{33600 \text{ A.P.K.}}{70} \text{ and } A = \frac{70 \text{ E}}{3600 \text{ P.K.}}$$

The area of the orifice depends on the lift of the valve and its circumference, that is the circumference remaining the same and the lift is doubled, the area of the orifice is doubled, or the lift being constant and the circumference doubled the area of the aperture is doubled. (NOTE: The area of the orifice varies directly as the dia. and by doubling the dia. the result is the same.)

An example will prove this.

Assume that the relieving capacity of a 4 in. pop valve having a flat seat is to be increased 100%. The lift being 1-10 of an inch.

The area of the orifice=πDL=

$$\frac{3.1416 \times 4 \times 1}{10} = 1.256 \text{ sq. in.}$$

If we double the circumference the area becomes

$$\frac{3.1416 \times 4 \times 2 \times 1}{10} = \frac{25.12 \times 1}{10} = 2.512$$

sq. inches.

But if we double the disc area of the 4 in. valve we do not double the relieving capacity.

Example:

Area of 4 in. disc = 12.56 sq. in. This multiplied by 2 = 25.12π in. and the corresponding circumference = 17.8 in. and orifice =

$$\frac{17.8 \times 1}{10} = 1.78 \text{ sq. in.}$$

instead of being doubled the area of the orifice is increased only about 42%, so that the only bearing that the disc area has on a safety valve problem is when calculating the load or spring tension required to hold the valve down against the steam pressure.

Practically all spring pop safety valves have 45 deg. seats and the discharge (E) is less than if the seat was flat. When calculating the area of the aperture having a valve with a taper seat the formula becomes

$A = \pi DL \text{ Cos. } \Theta.$
Where A = area of the orifice
Where π = 3.1416
Where Z = lift
Where Θ = the angle of the seat.

For a 45 deg. seat Cos Θ = .707. and the formula becomes

$$A = (\pi DL \ .707) = (2.21LD)$$

or combining this with Napiers Formula for a 45° seat.

$$E = \frac{2.21LD \ (360 \text{ A.P.K.})}{7} = 105$$

Then E = (105 L.P.D.)

and $$D = \frac{E}{105 \text{ L. P.}}$$

Now to show the absurdity of the prevalent idea that the area of the disc is the actual area of the aperture we will take for instance the formula used in the Canadian rules (Interprovincial Regulations adopted by most of the provinces of Canada) Section 272, page 93.

When working pressure exceeds 47 lbs. per sq. in. with coal fuel and natural draft.

$$A = \frac{37.5 \times G}{W \ P + 15}$$

This rule is also in use by the British Board of Trade.

Where A = area of the valve in sq. in. at the point of contact with seat.

Where G = Grate surface in sq. ft.

Where WP = Working pressure lbs. per sq. in. gauge pressure.

Example:

A boiler having 100 sq. ft. of grate. The working pressure being 185 lbs. gauge, find the area of the safety valve, that is required.

Then

$$A = \frac{37.5 \times 100}{200} = \frac{37.5}{2} = 18.75 \text{ sq. in.}$$

If we assume that 18.75 sq. in. is the area of the orifice the relieving capacity would be

$$E = \frac{360 \text{ A.P.K.}}{7} =$$

$$\frac{360 \times 18.75 \times 215 \times .925}{7} =$$

1,903,437 lbs. per hour or equal nearly 63,500 boiler H.P. Whereas the actual relieving capacity of such a valve is only about 16,000 lbs. per hour, and the actual area of the aperture or orifice is only 1.08 sq. inches, when the lift is 1-10 in. instead of 18.75 sq. in.

Now we will apply some of the well know rules or formulae to find the size safety valve required for the boiler already discussed and compare the results with the boiler capacity, assuming all to have 1-10 in. lift, the seats having a 45 deg. angle.

Old Rule

$$A = \frac{G}{2} = \frac{110}{2} = 55 \text{ sq. in.} = 8\tfrac{1}{4} \text{ in.}$$

dia. nearly.

Relieving capacity E = (105 L.D.P.) =

$$\frac{105 \times 8.5 \times 215}{10} = 18{,}906 \text{ lbs. per hr.}$$

Phila. Rule

$$A = \frac{22.5G}{P + 8.62} = \frac{22.5 \times 110}{208.62} =$$

11.86 sq. in. = 3. 7-8 in. dia. say 4 in.
Relieving capacity E = (105 L.D.P. =

$$\frac{105 \times 1 \times 4 \times 215}{10} =$$

9300 lbs. per hour.

Rankins Rule

$$A = \frac{1{,}406 \ W}{P + 8.62}$$

where W = Wt. of coal burned per hr.

$$A = \frac{1.406 \times 3740}{208.62} =$$

25.2 sq. in. = 5¾ in. dia. nearly.
Relieving capacity E = (105 L.D.P.) =

$$\frac{105 \times 1 \times 5.75 \times 215}{10} =$$

13,000 lbs. per hour.

Thurston

$$A = \frac{0.5\ W}{P-10}$$

Where W = Wt. steam generated per hour.

Where P = Gauge pressure.

$$A = \frac{0.5 \times 35{,}000}{210} =$$

83.33 sq. in. = 10 3-8 in. say 10½ in. dia.

Relieving capacity E = (105 L.D.P.) =

$$\frac{105 \times 1 \times 10\frac{1}{2} \times 215}{10} =$$

23,703 lbs. per hour.

B. O. T.

$$D^2 = \frac{\text{Grate area in sq. in.}}{3 \times \text{absolute pressure}} = \frac{110 \times 144}{3 \times 215} = \frac{15840}{645}$$

$D^2 = 24.56$.

$D = \sqrt{24.56} = 4.95$ say 5 in. or its equivalent.

Relieving capacity = (105 L.D.P.) =

$$\frac{105 \times 1 \times 5 \times 215}{10} =$$

11,300 lbs. per hour.

U. S. Supervisors of Steam Vessels

Old Rule

$$A = \frac{HS}{25} = \frac{6000}{25} =$$

240 sq. in. = 17¼ in. or its equivalent.

Relieving capacity = (105 L.D.P.) =

$$\frac{105 \times 1 \times 17.5 \times 215}{10} =$$

39,500 lbs. per hour.

U. S. Supervisors New Rule

$$A = \frac{0.2074\ W}{\text{Abs. pressure}}$$

Where A = sq. in. of safety valve required per sq. ft. G. S.

Where W = Water evap. per sq. ft. G.S. per hr.

$$A = \frac{20.74 \times 352}{215} \times 110 =$$

37.35 sq. in. = 7 in. dia. nearly.

Capacity E = (105 L.P.D.) =

$$\frac{105 \times 7 \times 215 \times 1}{10} =$$

15580 lbs. per hr.

Molesworth

$$A = \frac{4}{5} \text{ grate surface} = \frac{4 \times 110}{5} =$$

88 sq. in. = 10 5-8 in. dia. say 10½ in.

Capacity = E = (105 L.D.P.) =

$$\frac{105 \times 1 \times 215 \times 10.5}{10} =$$

23,750 lbs. per hr.

Thurston

$$A = \frac{4 \times \text{coal per hour}}{P + 10} = \frac{4 \times 3740}{210} =$$

Dia. = 9½ in. nearly.

Capacity E = (105 L.P.D.) =

$$\frac{105 \times 1 \times 215 \times 9.5}{10} =$$

21,225 lbs. per hr.

Rankin

A = 0.006 water evap. per hour = (0.006 x 35000) = 210 sq. in. = 16½ in. nearly.

Capacity = (105 L.P.D.) = (105 x 1 x 16½ x 215) = 37248 lbs. per hr.

Thurston

$$A = \frac{2\frac{1}{2} \text{ H. S.}}{P + 10} = \frac{2.5 \times 600}{215} =$$

Dia. = 9½ in. nearly.

Capacity = (105 L.P.D.) =

$$\frac{105 \times 1 \times 215 \times 9.5}{10} =$$

21215 lbs. per hour.

Mass. Rule

$$A = \frac{770\ W}{P}$$

Where W = Wt. water evap. per sq. ft. of grate surface per second.

And P = Absolute pressure.

$$A = \frac{770 \times 35000}{215 \times 3500} = 34.81 \text{ sq. in} =$$

6½ in. dia. nearly.

Capacity = E = (105 L.P.D.) =

$$\frac{105 \times 1 \times 215 \times 7}{10} =$$

14673 lbs. per hour.

Darling, for Stationary Pop Valves

$$D = \frac{0.068 \text{ H.S.}}{\text{L.P.}} = \frac{0.068 \times 6000}{0.1 \times 215} =$$

19 in. dia.

Capacity = E = (105 L.P.D.) =

$$\frac{105 \times 1 \times 215 \times 19}{10} =$$

43000 lbs. per hr.

For Marine

$$D = \frac{0.095 \times \text{H.S.}}{\text{L. P.}}$$

Where H. S. = Heating surface in sq. ft.

Where L. = Lift of valve.

Where P. = Absolute pressure.

Canadian Rule

$$A = \frac{37.5\ G.}{P + 15} = \frac{37.5 \times 110}{215} =$$

19.18 sq. in. = 6 in. nearly.

Capacity = E = (105 L.D.P.) =

$$\frac{105 \times 1 \times 6 \times 215}{10} =$$

13575 lbs. per hr.

The ratings or capacity of the safety valves as found by the formula (105 L. P.D.) are less than the actual capacity of the valves under test. This point can be discussed later on.

By application of 13 different rules the safety valve capacities given for a boiler having 6000 sq. ft. H.S. and 110 sq. ft. grate working pressure 200 lbs. gauge having natural draft, burning 34 lbs. coal per sq. ft. of grate, and evaporating 5.83 lbs. of water per sq. ft. H. S. Total evaporation per hour from feed water at 195 deg. into steam at 200 gauge 37,332 lbs. are as follows:

Rule 1 Old English	18,906 lbs per hr.
Rule 2 Philadelphia	9,300 lbs. per hr.
Rule 3 Rankin	13,100 lbs. per hr.
Rule 4 Thurston ..	23,703 lbs. per hr.
Rule 5 Brit. B.O.T.	11,300 lbs. per hr.
Rule 6 U.S. Supervisors (old)	39,500 lbs. per hr.
Do., (new)	15,580 lbs. per hr.
Rule 7 Molesworth.	23,750 lbs. per hr.
Rule 8 Thurston ..	21,225 lbs. per hr.
Rule 9 Rankin ..	37,248 lbs. per hr.
Rule 10 Thurston .	21,225 lbs. per hr.
Rule 11 Mass	14,673 lbs. per hr.
Rule 12 Darling ..	43,000 lbs. per hr.
Rule 13 Canadian .	13,575 lbs. per hr.

Out of 13 rules only three that give sufficient relieving capacity, when the application of the formula A = (105 L. D.P.) gives a valve in excess of 4½ in. did the nearest number of valves whose combined circumference are not less than that corresponding to the dia. found will be the size required.

Example:

If A = 201 sq. in. dia = 16 in. circumference = 50.26 four 4 in. valves are required since

$$\frac{50.26}{4} = 12.56 \text{ in.}$$

(But if we divide the area by 4 we have

$$\frac{201}{4} = 50$$

and a corresponding dia. of 8 in.). You see we have four 4 in. valves whose combined area (12.56 x 4) is only ¼ of the area of the 16 inch but having the same relieving capacity.

The foregoing will be interesting to engineers and we would welcome a thorough discussion of the subject. The engineer rarely has anything to do with the selection of the size of safety valve, (that is the operating engineer at least), but he is required to know all about them and to calculate the size, etc. He can figure his safety valve problems in Canada and be 15 per cent. wrong in Massachusetts, or if he figures them out in Massachusetts he will be 67½% wrong in Philadelphia.

There is a difference of 362% between the results found by some of the rules given here and there are yet more rules all equally disappointing.

MARINE NEWS FROM EVERY SOURCE

St. Johns:—On November 21st it was reported from St. John's Nfld. that the steamer "Ferm" en route from North Sydney to St. John's with coal was a total wreck at St. Shotts on the south coast of Newfoundland. The crew were all saved. The "Ferm" registers 972 tons net and is owned by the Ferm S. S| Company, Ltd., of St. John's. She was built in 1918 at Slidell, La., U.S.A. She was 248 feet long, 43.1 feet beam, and 18.1 feet deep. The steamer had a cargo of 900 tons of coal and carried a crew of 29 men.

Montreal: — The American Lake Steamer "Parks Foster" collided with the Manchester Line Steamer "Manchester Civilian" in the Montreal Harbor on Wednesday afternoon, November 16th when the latter steamer was lying at her berth at No. 16 shed. The damage to the Manchester steamer was not of a serious nature but it is estimated it will cost $25,000.00 to make repairs. The "Parks Foster" was seized soon after the accident and was released again on November 18th after putting up a bond for the sum of $25,000.00. The case was proved on November 21st and the date for the hearing in the Admiralty Court fixed. The case is thought to be assuming the earmarks of a hard fought suit.

It was announced on November 22nd by Furness-Withy & Co. Ltd., that the "Manchester Civilian" would be fit to go to sea on that date.

Montreal: — The passenger traffic through the port of Montreal concluded with the departure of the Canadian Pacific liner "Coriscan" on Nov. 26th and the approximate figures of the numbers carried show that a total of 106,310 passengers have passed over the Montreal wharves during the 1921 season. This total while it is considerably below that of last year, which was abnormal in many respects, is up to the average and considered satisfactory by the steamship lines, particularly when the present worldwide commercial depression is taken into consideration. Of the total given 65,218 landed at Montreal from British and Continental ports, while 41,092 sailed from Montreal.

Passenger liners made 84 round trip voyages to Montreal during the year.

Vancouver:—Captain A. J. Hosken and members of the crew of the Canadian Pacific liner "Monteagle," which reached Victoria, B.C., on November 22nd, and Vancouver on the 23rd, from Hong Kong and Yokohama were decorated on their arrival with the medal of the Royal Humane Society in connection with the rescue of the passengers and crew of the French steamer "Hsintein" when that vessel foundered off the Lammocks on the Chinese Coast, April 8th last. The medal was presented by the Lieutenant-Governor of British Columbia.

It will be remembered that but for the timely arrival of the "Monteagle" heavy loss of life would have resulted as the French steamer carried no wireless. The rescue is stated to have been accomplished under circumstances that called for exceptional presence of mind and skilful and courageous seamanship.

Quebec:—The British Steamer "Gyp" Captain Isaacs, bound from London to Chicoutimi to load with pulp wood, went ashore at St. Etienne Bay in the Saguenay River on Saturday, November 19th. The vessel was refloated by the steamer "Lord Strathcona" of the Quebec Salvage and Wrecking Co., and then proceeded to Quebec under her own steam where a survey of the vessel was made to ascertain the extent of the damage.

Lunenburg:—The Grand Banks fishing fleet of Lunenburg N. S. caught 269,830 quintals of fish during the past season, which is the third largest catch in the history of the industry. The fleet consisted of 94 schooners and one steam trawler. Captain Albert Himmelman in the schooner "Independence" caught 4,750 quintals which was the highest individual catch of the fleet. The average catch per vessel was 2,840 quintals which was a record for averages.

In 1912 Lunenburg had 136 schooners engaged in the Bank fisheries and the catch was 211,080 quintals. The biggest average catch was made in 1919 when 106 schooners took 285,150 quintals. The second largest average catch was made in 1920 when 117 schooners caught 291,475 quintals.

Montreal: — The Canadian Pacific Steamships liner "Minnedosa" which arrived from Liverpool on Saturday, November 19th, had among its passengers Captain George Tibbs, master of the Newfoundland 133-ton schooner "Nordica," and five members of the crew, who were shipwrecked on the coast of Corsica, and who are on their way back to Newfoundland. Captain Tibbs stated the "Nordica" sailed from Newfoundland on August 15th last with a cargo of fish with instructions to call at Lisbon, Portugal, for orders. Orders were received at Lisbon to proceed to Naples Italy. There the cargo of fish was discharged and the schooner cleared for St. Pala, Spain, where a cargo of salt was to be taken on. En route to St. Pala the schooner was caught in a storm, carried off her course, and driven on the coast of Corsica, where she was wrecked on the rocks a short distance from the land. The vessel was being pounded on the rocks when the danger was seen by the people on the island. The position was desperate, as the small boat was full of water and could not be launched. Finally a male resident of the island came along on horseback and urged his animal into the surf with a line in hand. He fought with his horse valiantly to reach the schooner and after five desperate attempts managed to get his horse to swim to the schooner where the crew caught hold of the line that he brought out. With considerable difficulty the line was laid to the waterlogged boat, and the crew got into it, though it was half full of water, and were pulled ashore safely. The schooner very soon afterwards broke up. Nothing was saved from the ship. From Corsica the captain and crew went to Marseilles, thence to Paris, London and Liverpool, where the Minnedosa was boarded. The schooner was owned by Messrs. Pallon and Forsey of Grand Bay, Newfoundland.

Sorel:—Because of the reported shortage of live eels in New York City the fishermen of the lower St. Lawrence have entered this market and have built specially designed boats which will deliver the eels alive at the New York market. The first shipment of eels arrived at New York on Nov. 17th. It consisted of 200,000 silver eels which were placed in the special barges. The water flows in and out of these barges and is kept replenished in this way in transit. The fish were taken to New York by way of the lakes, the Champlain Canal and the Hudson River. The eels did not seem to suffer in passing from salt water to fresh water and then back to salt water again. Three of these barges were sent down in charge of a tug. The experiment was entirely successful and no doubt the new type of eel barge will become a standard unit of fish transportation.

Halifax:—The steamer "Idy of Gaspe" which went ashore in August last on Thrum Cap Shoal, broke in two during a recent gale, the heavy seas proving too much for her. She was in the Boston-Halifax, St. Johns service at the time she went ashore.

Meaford:—The steamer "James Dempsey" of Chicago, arrived in the port of Meaford on Thanksgiving Day with a cargo of lumber for the Seamen Kent Co., measuring 600,000 feet. Although it was a holiday, the entire staff of the firm turned out to get the vessel unloaded

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Toronto:—The Mathews Steamship Co. of Toronto recently purchased nine French freight steamers, which are now being sailed across the Atlantic, and will be placed in service on the Great Lakes. The vessels were built in the U.S. during the war. It is understood that the purchase price was in the neighborhood of $2,500,000.

Newcastle-On-Tyne: — The Cunard liner "Andania" one of the new intermediate fleet of ships which this line are building, was launched at the beginning of this month at Hebburn, on the Tyne. She is 540 feet long, by 65 feet beam and 43 feet depth, and 14,00 tons d.w. She will probably be placed in the Canadian service next spring.

Kingston:—The steamer "Aragon" which went ashore on Salmon Point 60 miles west of Kingston on November 18 is in danger of breaking up according to despatches from Kingston dated November 21. The Donnelly Wrecking Co. have removed 4,000 bushels of corn from the hold, but they are handicapped by the high seas, and have had to run for shelter till the weather moderates.

Montreal:—A pleasing ceremony was performed in the harbormaster's office here on Nov. 1st, when Capt. Bourassa was presented with a malacca cane the gift of the harbor employees on the occasion of his seventieth birthday. The presentation was made by Mr. M. P. Fennell on behalf of the employees, and congratulatory addresses were also made by the chairman of the Harbor Commissioners and other members of the staff. Capt. Bourassa has been in the harbor service for thirty years.

Montreal:—The firm of Vickers Ltd., Montreal are anxious to obtain the contract from the Government for the building of an icebreaker, for the St. Lawrence service. In connection with this, the employees of the firm held a meeting at which they discussed the advisability of reducing their wage rate voluntarily in order to enable the firm to secure the contract. This would mean the employment of 500 to 600 during the winter, which would be a great help in the employment situation of the country.

Montreal:—The Canadian Government have asked for tenders for a mail and passenger service between Canada and the British West Indies, and British Guiana. The tenders will be for weekly or fortnightly sailings from St. John or Halifax alternately between these two ports. The steamers will be expected to have a capacity for about 250 passengers, in three classes.

Detroit:—The navigation season on the Great Lakes will close soon after the 1st December of this year, as the U.S. and Canadian Lighthouse Services are arranging to withdraw the navigation aids on Dec. 1st. It is expected that by Dec. 8th practically all the light vessels and buoys will have been removed by both authorities.

Montreal—The Head Line Steamer Lord Downshire arrived at Montreal on Nov. 15th from Dublin with a young lioness on board. The animal was on its way to the Zoological Gardens in Toronto. It is only a year old and although the liner had a stormy passage the animal did not seem to suffer from seasickness and always appeared ready to eat her meals of rabbits and other meat.

Toronto:—It is estimated that the navigation season from this port will be a little earlier closing this season than usual, December 3 being named as the probable date. The "Maccassa"is still running between here and Hamilton. Lake navigation in general has closed somewhat early on account of a shortage of grain cargoes. but the past season from a passenger point of view has been a very good one.

Windsor:—The death occurred early this month of Captain Peter Williams at the age of 74, after a long illness. For the past thirty years he had been in command of the Windsor Ferry Co.'s steamers between Detroit and Windsor and before the present company was in operation he was chief engineer of the old cross ferry "Argo." His lake service altogether extended over nearly 60 years and for 70 years he had resided in the Border cities.

The steamer "Slieve Donard" was launched from Vickers' shipyard, Barrow, on Thursday, October 6th. The vessel was built for the London and North-Western Railway Company's Dublin-Holyhead service. She will carry cargo and passengers and will be able to maintain a speed of 16 knots.

Mr. G. H. Banister, a director of Vickers, is quoted as saying that the heavy oil marine engines installed in the "Donard" are a decided success for engines operating on the internal combustion principle. He further states that they are both economical and efficient and that the past record of these engines encourages Vickers to believe that the question of fitting those engines to fast cross-Channel vessels would before long become a practical one. He thought that no ship owner or shipbuilder could afford to disregard the achievements and possibilities of the heavy oil engine in either merchant or navy ships.

Port Hastings:—The schooner "Maple Leaf" which was reported lost in the gale on Saturday, Nov. 12th, along with three other schooners en route from Port Hastings to Charlottetown, P.E.I., has turned up safely in Pictou Harbor.

Sydney.—The schooner Maple Leaf, which sailed from the Gut of Canso, for Charlottetown, P.E.I., on Saturday morning, Nov. 12th, is reported lost. The Maple Leaf was commanded by Captain Parsons and carried two other men. Three other schooners that left the Gut of Canso at the same time, all bound for the same port were wrecked on Saturday night. The schooners were the Arizona, the Hazel Dell, and the Howard.

Levis—The steam barge Thunder Bay, which passed up the Lachine Canal on Monday, Nov. 14th, en route to the Great Lakes had just been subjected to the unusual treatment of having her length reduced by 60 feet. The work was done at the plant of the Davie Shipbuilding Co. at Levis, P.Q. This reduction in length was necessary to enable the boat to pass up the St. Lawrence River canals and the Welland Canal so that she could enter the grain traffic in the Upper Lakes. New boilers and new propelling machinery were installed in the steamer. At the present time the barge Hamilton is undergoing similar treatment at the Davie plant.

Montreal:—The raising of the night gas buoys on the River St. Lawrence Channel between Montreal and the lower St. Lawrence was commenced on Monday, Nov. 21st. These gas buoys will be replaced with the spar buoys which will remain in place until the last steamer has passed down the river for the season. This will not seriously affect the natural run of shipping in the river as for some time past there has been little or no night navigation on the river.

Montreal:—According to the sailing schedule of the summer of 1922 issued by the White Star-Dominion Line on Nov. 17th the new 16,315 ton liner "Regina" will leave Liverpool on her first trip to Montreal on April 29th next. She will make seven round trip voyages during the season. The "Regina" is now at the Belfast yards of Harland and Wolf will be ready for service in February. She is expected to make two round trips to Portland and Halifax before being placed on the St. Lawrence route.

It is also rumored that the new 16,500 ton White Star steamer "Doric" now completing for the Montreal, Liverpool run at Belfast and the third class carrier "Vedic" will be seen on the Montreal route next season.

Quebec:—Messrs. Lachance, Ltd., who have been occupied on the salvage operations of the C.G.M.M. steamer "Canadian Recruit" have abandoned the steamer for this season and there is little hope that there will be anything to salvage next year. The salvage operations were commenced on September 11th and were continued until Nov. 16th. During this time only four days work was done owing to unfavourable weather conditions. One of the coffer dams was lost recently and thus prevented further work until it was replaced. In passing it may be interesting to note that this steamer has had one mishap after another all through her short career on the high seas, and at the same time is the only vessel in the C.G.M.M. fleet whose name does not end in "r".

Montreal: — The Canadian Pacific Steamships, Ltd., announce that the steamer "Montcalm" is being completed much faster than expected and that her first sailing will be from Liverpool on January 18th instead of February 15th. She will sail to St. John, N.B. The "Montcalm" was built by John Brown & Co., Clydebank, Scotland. She is the first of the two of the M class of boats to be built by this firm. The second steamer is the "Montrose." This latter steamer is being rapidly completed for service. A third steamer the "Montclare" is under construction at the yards of the Fairfield Shipbuilding and Engineering Works, Govan, Scotland. All three steamers are described by the following description. They have two funnels, 566 feet long, 70 feet beam, 51-¼ feet moulded depth, 16,000 tons and are able to maintain a speed of 17 knots. There will be accommodation for 520 cabin passengers and 1550 third class passengers.

These steamers will be employed on the Montreal—Liverpool run during the season of open navigation in the St. Lawrence.

The modified cruiser stern which has proven so popular since its first use by the Canadian Pacific Steamships is one of the features of the steamers. The steamers are all built to the requirements of the highest class of Lloyds' register under special survey, and are classed A100-A1, as well as fulfilling all the requirements of the International Conference on Safety of Life at Sea, and the British Board of Trade, and fully complying with the Canadian and American laws for passenger steamships.

Montreal. — The Canadian Pacific Steamship Limited announced on Tuesday, November 15th, that the new Empress of Canada will be delivered to them toward the latter part of February, 1922, and this steamer is expected to be on the Vancouver, Yokohama, Hong Kong route by the first of April at the latest. The "Empress of Canada," it will be remembered, is to be the finest passenger ship on the Pacific coast as she possesses all the conveniences of her predecessors, the Empress of Russia and the Empress of Asia, with many modern improvements in addition. On her trial trip she averaged 20.5 knots per hour and this is to be her regular speed.

St. John:—The three masted schooner "Jennie V. Merriam" was burned to the water's edge and sunk on Monday evening, November 7th at Hopewell Hill, N. B. The schooner was 454 tons register and was loaded with plaster at Hillsboro. On the evening of Sunday, November 6th she dropped down the Petitcodiac River to Hopewell Hill, where she anchored for the night in the stream, expecting to continue her trip on Monday. Preparations were being made to get the schooner under way when the gasoline winch engine back-fired causing the vessel to take fire, at about eight o'clock Monday morning. The flames spread so rapidly that it was found impossible to lift the anchor and beach the craft. When it was seen that the vessel was doomed the crew abandoned her and came ashore. The fire continued to burn fiercely until about eight o'clock in the evening when the vessel sank. The cargo was shipped by the Alberta Manufacturing Co., and was destined for ports down the Bay of Fundy. It was claimed that there were 800 tons of plaster on the vessel.

IMPROVING BRITISH PORTS

Everbody will have heard the story of the American who was contemptuously comparing the Clyde with the Mississippi and who was silenced by the observation that while Providence had been responsible for the Mississippi, human engineers had made the Clyde. It is a literal fact that the famous home of shipbuilding and sea commerce is largely an artificial waterway. Still the work of improvement begun nearly a hundred years ago, is being continued. Now docks are about to be constructed which will give six large paralled basins with direct entrance from the river and will add about seven miles of quays to the accommodation of the port. The total cost of the new works will be about £2,000,000. Ambitious developments are also proceeding at the port of London. A new cargo quay, 1000 feet long has just been put into service and plans for a large passenger stage at Tilbury and for big extensions to dock accommodation are being prepared.

The "City of Paris" built at the Wallsend Shipyard of Messrs. Swan, Hunter, & Wigham Richardson, Ltd., for Ellerman's City Line, has just left the works of the Wallsend Slipway & Engineering Co. where the engines and boilers were constructed. The ship has a single screw driven by double reduction geared turbines of the impulse reaction type. Both the ahead and the astern turbines have one high pressure and one low pressure turbine working in series. Superheated steam is supplied from five single-ended boilers working under forced draught at a pressure of 225 lbs. per square inch. The machinery and the hull of the ship have been built to Lloyds highest class and to the Board of Trade requirements for a passenger certificate. The leading dimensions of the "City of Paris" are 504 ft. overall with a moulded breadth of 59 ft. and a depth to the upper deck of 35 ft. She has been designed to carry 10,500 tons deadweight on a draught of 28 ft. 2 ins. Oil fuel is carried in the deep tank and double bottom, except under the engines and boilers. As the ship is to run to India most careful attention has been paid to the ventilation of all living accommodation. There are comfortable staterooms in deckhouses on the promenade and shelter decks for 230 first class and 100 second class passengers. In the upper 'tween decks of two of the holds,, provision is made for third class passengers forward, while that for the second class passengers, together with a lounge, is in a deckhouse on the shelter deck above the after hold. The first class smoke room is at the after end of the central promenade deck, and below it is a nursery for children. For perishable provisions, refrigerated rooms are provided. In order to deal with cargo as expeditiously as possible, there is a fine equipment of powerful derricks and winches. The captain and officers are placed in deckhouses abaft of the wheelhouse on the boat deck, the engineers being accommodated at the afterend of the same deck, and the crew in the ship's poop.

LAUNCH AT MIDDLESBOROUGH

On Monday, the 31st October, 1921, Sir Raylton Dixon & Co.. Ltd.. launched from their Cleveland Dockyard, Middlesbrough, a large steel screw steamer which they are constructing for La Compagnie des Chemins de Fer de Paris a Lyon et a la Mediterranee, whose shipping business is managed by their subsidiary Company, La Societe Nationale d'Affretements.

The principal dimensions of the vessel are 400 x 56 x 31 moulded and she will have a deadweight carrying capacity of about 8900 tons on a light draft of water. She is being built under special survey to receive Lloyd's highest classification also to meet the requirements of French law.

Quadruple expansion engines, placed aft, having cylinders 23, 32½, 47 and 68 by 48 stroke, supplied with steam by three large single-ended boilers working at 220 lbs. pressure, having Howden's system of forced draught, will be fitted in the vessel by Messrs. Richardsons, Westgarth & Co. Ltd., Middlesbrough.

The vessel and her machinery are being constructed under the super-intendence of Monsieur Marechal and Captain Veyrat of La Societe Nationale d'Affretements and Mr. Reginald J. Eyres of Messrs. Eyres & Bryers, Newcastle-on-Tyne, Sunderland and Marseilles.

On leaving the ways the vessel was gracefully christened "P.L.M.25" by Madame Van der Kemp, wife of Captain Van der Kemp, Marine Superintendent of the Managing Owners.

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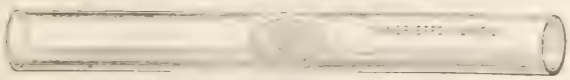
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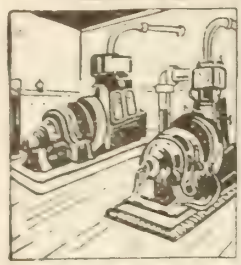

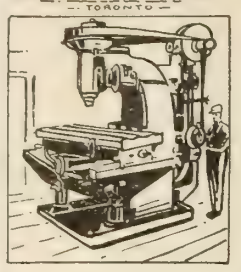

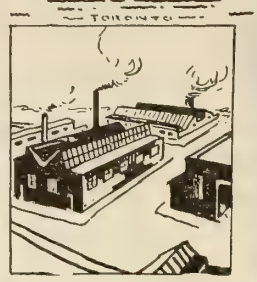

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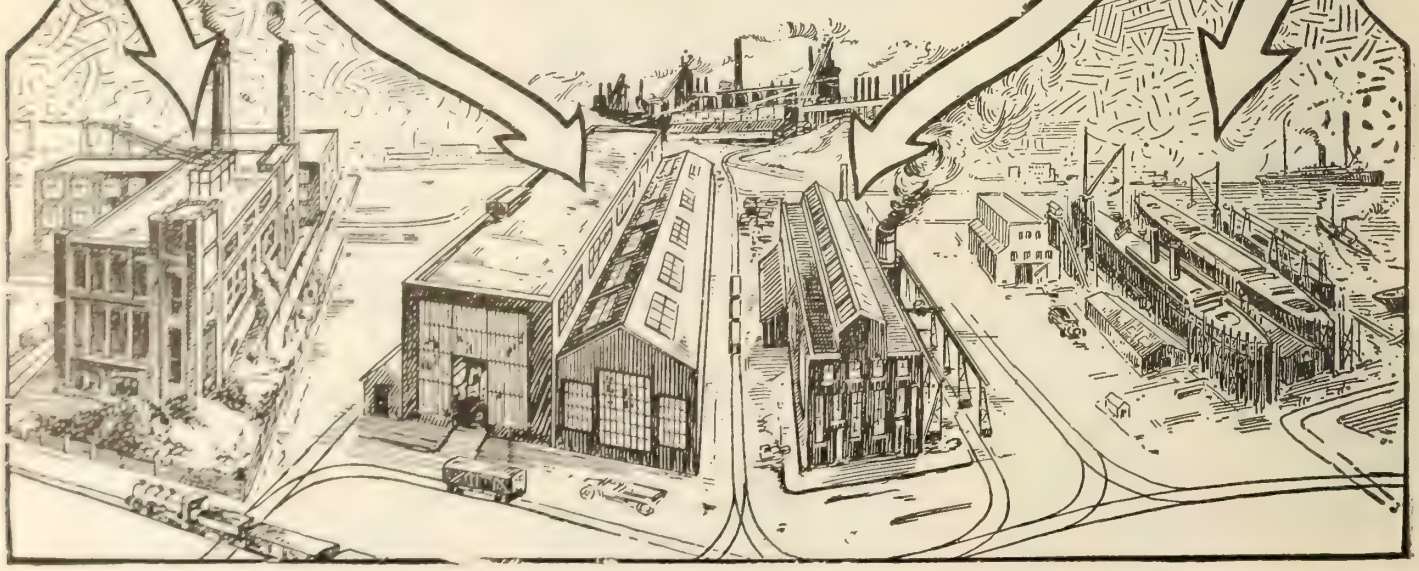

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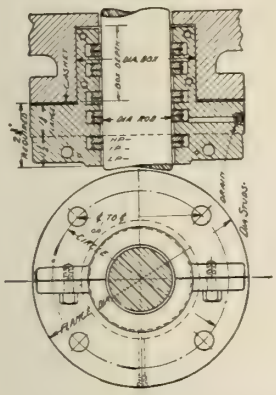

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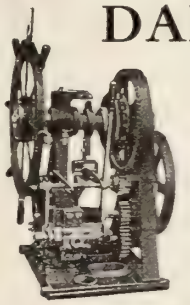

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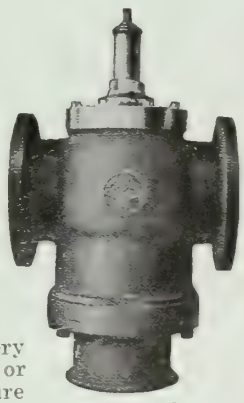

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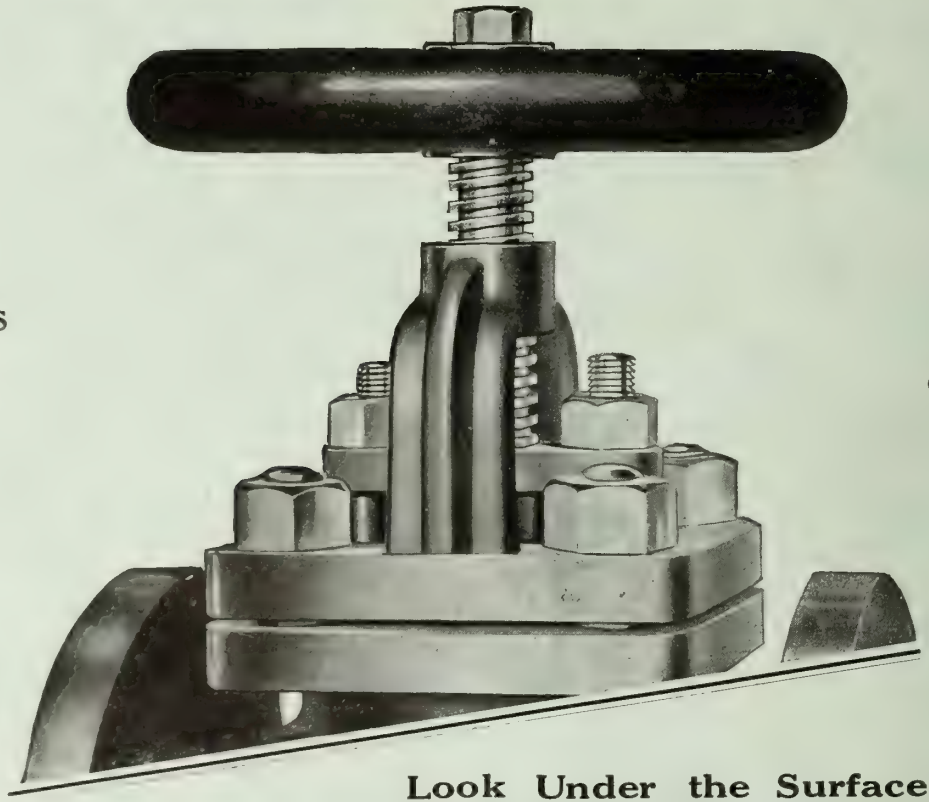

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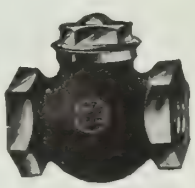

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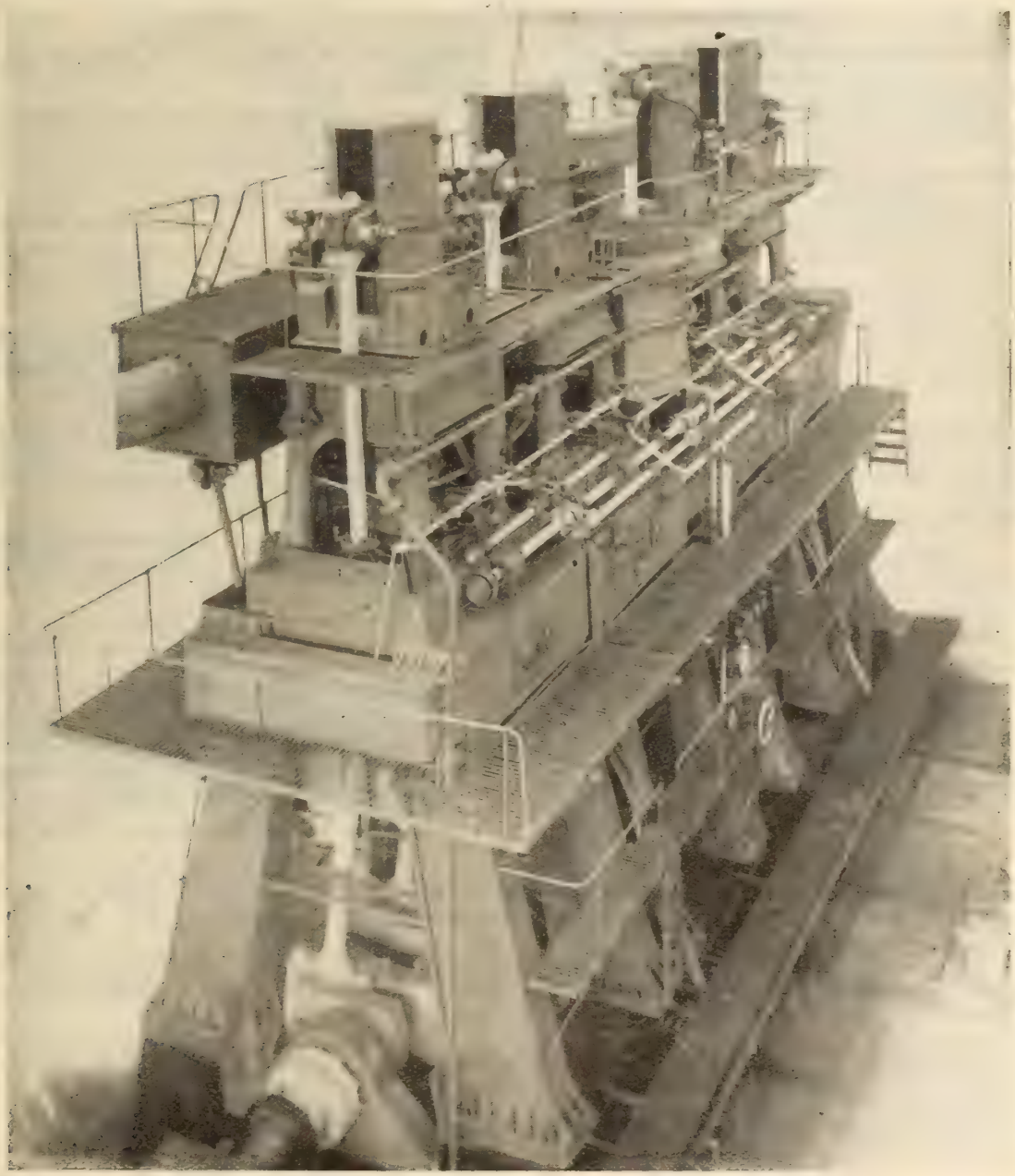

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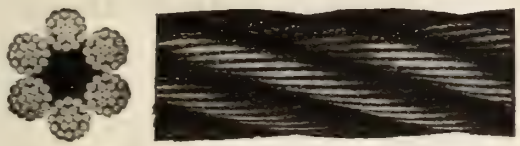

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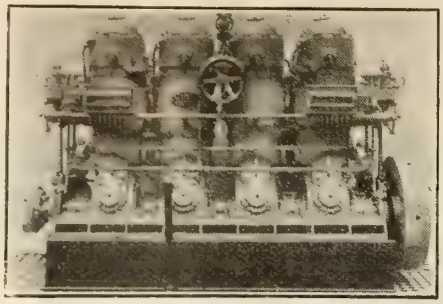

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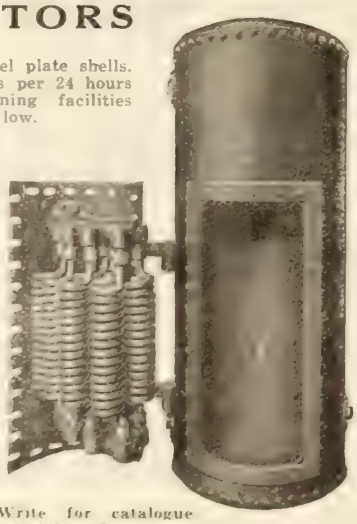

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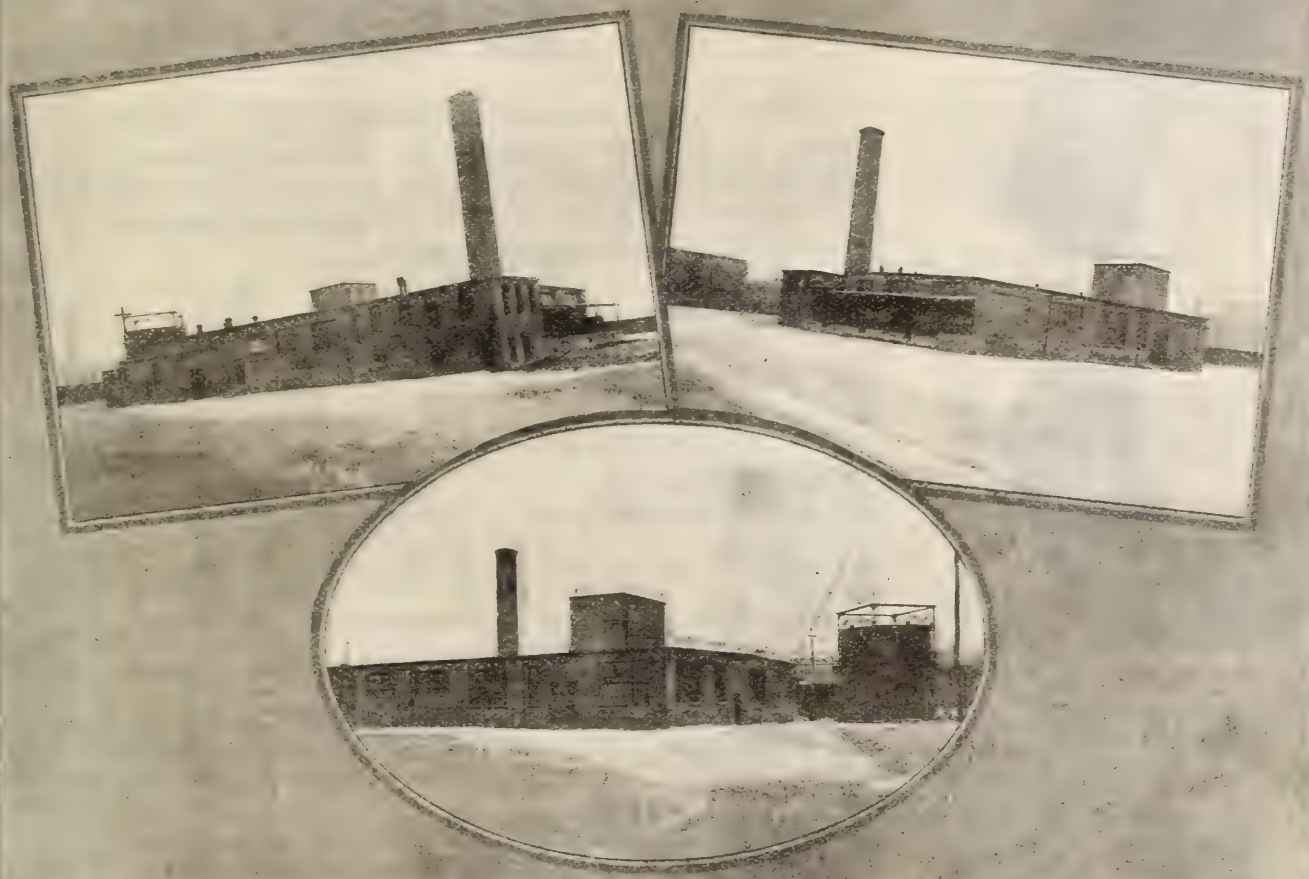

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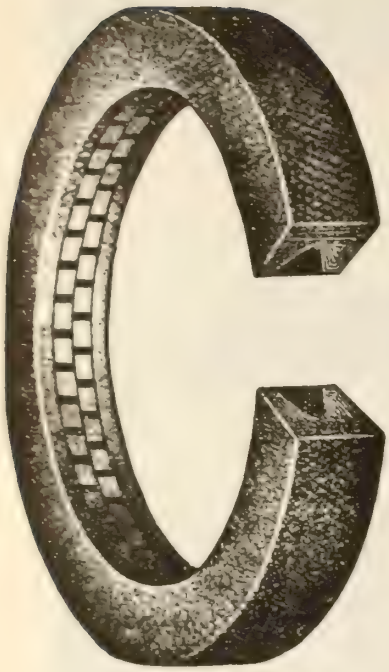

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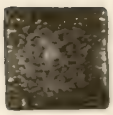

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MARINE ENGINEERING
OF CANADA

Volume XI DECEMBER 1921 Number 12

The British Mercantile Marine in the War

This Stirring Resumé of the Services Rendered by Private Shipping to the National Effort from 1914 to 1918 Shows What a Great Part It Played in the Ultimate Success

*By SIR JOSEPH MACLAY, Bart.

IN MIDSUMMER of 1914, the inhabitants of the British Isles little dreamed that in the early days of autumn they would be engaged in the greatest war in history, a war which imperilled not only Great Britain, but the continuance of the British Empire.

Germany, one of the greatest nations of the world, which, during the previous 50 years had developed her resources probably more quickly than any other nation, and which had obtained by the genius and enterprise of her people a front place in commerce in almost every country dissatisfied with only commercial supremacy and inebriated with ambition, desired also to obtain world-wide political supremacy and power.

Systematically developing its plans over a long period of years with devilish cunning, and believing in 1914 that the time had come to carry out its great purpose, Germany forced war on Europe, bringing into the fray ultimately, one by one, practically all the civilized powers of the world.

Its leaders had made calculations which they believed would bring to them victory, but in their unholy ambition they had forgotten that apart from the power of other nations there was a God who controlled all.

It will ever stand to the credit of Great Britain that in 1914, she was so unprepared for war, and nothing was further from the nation's dreams: although it may be questioned if in view of what we know to-day about the preparations of Germany, the British Government had not a responsibility for its lack of knowledge and unpreparedness.

Part Played by Shipping

With the coming of the war, all the great services possible to the State were immediately called into requisition, and it is my purpose to-night to say something of the part played by British shipping.

I would remind you that the Mercantile Marine of Great Britain has been built up not by Government help and subsidies as in many other countries, but by the genius and enterprise of great ship builders, engineers and shipowners, added to by the courage and ability of those who go down to the sea in ships.

During a long period of years, every invention or improvement had been taken advantage of, and in 1914, Great Britain possessed not only the largest amount of shipping afloat, but her Mercantile Marine was composed of the finest ships of every type.

On the outbreak of war, the total number of ocean-going steamers under the British flag (over 500 tons gross register) was about 5,000, with a gross tonnage of about 18,500,000 tons. Some 350 of the largest were almost immediately requisitioned by the Government for use as Auxiliaries for purely Naval purposes. This number gradually increased until it reached its highest point towards the middle of June, 1916, when 1,181 vesse's of 3,531,029 gross tons were so employed. In this were included all types of ocean-going vessels, and the services they rendered were many and varied.

Armed Merchant Cruisers, Armed Boarding Steamers, Mine Sweepers, Air Service Auxiliaries, Mine Carriers, Mine Layers, Fleet Messengers, Army Escorts, Colliers, Frozen Meat Ships, and Hospital Ships, etc.

From the middle of June, 1916, the number so employed on Naval services gradually decreased until at the date of the Armistice they had been reduced to slightly under 500 vessels of a gross tonnage of about one and one half million tons (oilers excluded) but it is to be noted that from the beginning of 1917, when 857 ocean-going vessels of 2,511,189 gross tons were employed, many services previously rendered by ships under direct Naval control were carrried out in requisitioned vessels running under Government commercial auspices.

The foregoing did not constitute by any means the total Mercantile craft which rendered direct assistance to the Navy, as at one time no less than 457 small vessels were also employed on Naval service.

Further, 45,000,000 tons of coal for British Naval and Military purposes were conveyed during the war in requisitioned British steamers, and a further 20,000,000 tons for Allied purposes.

The demands by the Navy for fuel oil grew rapidly during the war, and although by Armistice time the Government owned no less than 122 oil carrying vessels and had on requisition 110 privately owned of a total gross tonnage exceeding 1,000,000 tons, this was insufficient to meet the requirements of the Navy. In order to meet these requirements, the expedient was adopted of fitting the double bottoms of merchant vessels trading on convenient routes for the carriage of oil fuel. 758 vessels were so fitted, providing an oil carrying capacity in their double bottoms of 656,424 tons. 102 of these vessels were lost by war and marine risk, and the total number in service at the Armistice was 656, with a capacity for oil of 570,739 tons.

Military Service

Let me now deal with the requirements for tonnage for military service. On the declaration of war, arrangements for the cross Channe. transport to France of the Expeditionary Force were instantly made, and on the night of August 5th, 1914, 250 ships were requisitioned for this purpose. The embarkation commenced on August 9th, and the despatch of the first Expeditionary Force in 14 days was completed according to programme.

Like most other services, those of the Army Sea Transport grew beyond all calculation, and by the end of the year 1914, 964,000 individuals had been transported between the United Kingdom and Overseas destinations. By the end of 1915, this figure had grown to over 4,000,000, by the end of 1916 to 9,000,000, by the end of 1917, to 16,000,000, and by the date of the Armistice, to about 24,000,000.

A call for tonnage in the early stages of the war, which required many vessels, consequent on distance, was to bring from Britain's colonies—from Australia, New Zealand, India, China, Canada, South Africa, and the islands of the sea, wherever flew the British flag, the sons and grandsons of Empire, flocking homewards to the old land of their

*Transactions of the Institute of Marine Engineers.

fathers to give their help in its time of trial and need.

It is difficult to give a figure for the total quantity of stores moved for the Army, the items being so much mixed up with civil shipments, but taking only the quantity of completed Army stores landed in the theatres of war the figures are:

To the Armistice 49,000,000 tons weight, equal to 122,000,000 shipping tons; or if we take up to November, 1920, 56,000,000 tons weight, equal to 140,000,000 shipping tons.

During the latter stages of the war, no less than 90,000 tons of Army stores were being sent to France only each day.

In this connection it is interesting to note the development of ports consequent on the war. The facilities of places such as Dover, Folkestone, Plymouth and other useful British ports, specially in the English Channel, were developed and taxed to the utmost, and other places scarcely previously recognized as ports were brought into service. For instance Newhaven prior to the war was used only for passenger and cargo services to France with an occasional small collier with coal for Sussex towns. During the war about 6,000 tons weight, probably equal to about 13,000 shipping tons of Army stores per day were sent via Newhaven, on which 40 cross-Channel ships were based. In addition, the port was used as a fuelling base for destroyers, minesweepers, hydroplanes, aeroplanes, and as a base camp, and a little place like Littlehampton—practically unknown except as a seaside resort—handled about 7,500 to 10,000 shipping tons of Army stores per week.

For the movement of horses and other animals the demand during the war for shipping facilities was enormous.

About 2½ millions were carried by sea for Army purposes. Many of these were for very long voyages, such as Australia, to Mesopotamia, India, Egypt, etc., also from the River Plate to Egypt, France and the United Kingdom, etc., and when the British Army in France was growing daily and obligations in the Near East were being undertaken, 40,000 horses and mules were being brought monthly from U. S. A. and River Plate to the United Kingdom.

The shipments for Army account were of a very varied nature. Camels were shipped in large numbers, and on one occasion (for military-political purposes) British shipping was called upon to provide a vessel to convey the holy carpet and pilgrims to Jeddah for the annual pilgrimage to Mecca. The only ship readily available at the time was an ex-German steamer, and as it was not advisable to use a ship with a German name for the purpose, the name was changed.

Submarines

Of the many difficulties and dangers encountered in the carrying out of these [illegible] by far the most serious, was the rapid development of the submarine campaign by Germany, until early in 1917, it became apparent that we had reached the crisis of the war, and when in May of that year the losses under the British flag alone amounted to about 500,000 tons, there was reason for the deepest anxiety.

Up to the beginning of 1917, the construction of Mercantile Marine had practically been suspended in favor of ships for the Navy, but when the seriousness of the losses by submarine attack was realized, the British Government started to build on their own account together with Naval vessels, a large fleet of steamers suitable not only for Government purposes, but for the ordinary requirements of the nation.

Not only were the ships built in British yards, but every possible berth in yards in Canada, United States, China and Japan were secured. In the United States alone, contracts were placed for 171 steamers, representing over 1,000,000 tons deadweight, but when the United States entered the war, all vessels building on British account were seized by the United States, and so this large tonnage was lost to us.

Happily, however, with the introduction of the great convoy system in 1917, which humanly speaking, saved the war, together with increased protection against mines, the losses by submarine action became less serious, and the Naval authorities as the war further progressed, got far towards the mastering of this, the gravest of perils.

The position was also greatly helped by the coming into the war of the United States, bringing with it the possibility of additional convoy protection as well as great shipbuilding development.

Let me here enumerate some of the outstanding achievements of the British Mercantile Marine.

1. The supply of tonnage for Naval purposes, without which the Navy could not have carried on—armed cruisers, etc., as already stated.

2. The immediate transportation on declaration of war of the Expeditionary Force to France, including stores, guns, and personnel of every character.

3. The bringing of the fighting men from the colonies, etc.,

4. The transport of troops, horses, stores and necessaries of war to Gallipoli, Egypt, Mesopotamia, etc.

5. The keeping of our own country supplied from overseas with food and other necessaries of life.

6. The supply of tonnage to our Allies for food and war requirements.

7. The transport of United States troops and war stores.

Let me give you some figures.

During the actual period of the war and till November, 1920, the troops and personnel transported to and from all the fighting fronts, including France, Gallipoli, Egypt, Mesopotamia, &c., from and to Great Britian, India, Australia, New Zealand, Canada, the Cape, etc., amounted to 28,719,315.

1. Troops and Personnel	28,719,315
2. Sick and Wounded	3,221,992
3. Nursings Siters, and Civilians.	929,521
4. Refugees	133,510
5. Prisoners	336,398
Total number moved	33,340,736
Horses and Mules	2,400,654
Vehicles	553,829

An enormous total.

Let us now look at the losses of shipping during the war by submarine and other risks, including only vessels of 500 tons gross and over. The dates indicate the period of the rise and decline of the power of the submarine:—

	Tons gross.
From August to December 1914	865,000
From January to December, 1915	1,418,000
From January to December, 1916	1,578,000
From January to December, 1917	4,079,000
From January to November, 1918	2,003,000
Total	9,943,000

New vessels, however, built and secured from all sources were added to the extent of about 5,000,000 gross tons together with a considerable amount of foreign shipping, and there was on the British register at the close of the war 3,285 vessels over 500 tons survey, representing in all, about 14,500,000 tons.

The real losses, however, were much more than the mere figures indicate, because whereas the losses were in many cases drawn from the liner class of ships, the replaced tonnage was of the simplest kind.

Details of the actual manner in which all the vessels on British register over 500 tons gross at a given date were employed are interesting. In August, 1918, shortly before the war ended, the number was 4,050, engaged as follows:—

		Gross tons.
1. For British Naval purposes	500 vessels	2,000,000
2. For Military purposes	500 vessels	1,850,000
3. For Allies purposes	650 vessels	2,000,000
4. For the Colonies (not available for direct war purposes,)	120 vessels	450,000
5. Trading abroad and coasting (not available for war) purposes,	750 vessels	1,700,000
6. Repairing	250 vessels	1,150,000
7. Government Commercial Services	1,200 vessels	5,850,000
Total	4,050 vessels	15,000,000

Thus the total tonnage available in August, 1918, for all the general requirements of Great Britain was only about 6 million tons, and it was to this 6 million tons, together with some assistance from foreign tonnage that Britain had to look to meet her needs.

It has also to be borne in mind that loss of time to ships during the convoy period was enormous, consequent on times of waiting to suit convoy sailings and much reduced speeds.

Imports had to be reduced to the extreme limits on which the country could subsist and purchased regardless of cost as far as possible, from the countries oversea nearest to Great Britain.

No British ship was allowed to load a cargo without Government approval, and the great lines had their sailings all working under Government requisition drastically cut down. Before the war there were about 114 sailings per week to India, China, Japan, Australia, Africa and South America alone. Those were reduced gradually till they reached about 20.

The shrinkage of imports was enormous.

In the year before the war, 1913, they amounted to 54,500,000 tons gross. By 1917 they had fallen to 35,400,000 tons gross, while for 1918, they were estimated at 30,000,000 tons gross (excluding oil for the Navy).

Let me now tell you of the nature of the imports during these years which is even more interesting.

	1913.	1917.	1918. (estimate)
	Tons.	Tons.	Tons.
1. Food	18,000,000	14,300,000	13,000,000
2. Munitions and war material ..	———	16,850,000	14,000,000
3. Civil Supplies cotton, wool, tobacco, paper, &c.	36,500,000	4,250,000	3,000,000

In 1916 our imports really only included 9% of ordinary civil supplies, and 91% consisted of food and munitions.

Previous to the outbreak of war this country had received a large percentage of her imports by foreign ships.

In 1913 37% was carried in foreign ships, but this source rapidly declined, and

In 1917 only 18% was carried in foreign ships, and

In 1918 (estimate) 15% was carried in foreign ships.

The Allies

We now come to details of what was done by British shipping for our Allies. It has never been sufficiently realized how we starved and denied ourselves that we might save them. In 1918 France had the equivalent of over one million tons gross of British shipping in her services.

43% of her total imports were carried in British ships.

50% of her import of coal (1,600,000 tons a month) was carried in British ships.

492,000 tons of cereals out of 784,000 tons imported into France were carried in three months alone.

France had the benefit of coal at bunkering stations abroad which were kept supplied by British ships.

France had over 400,000 tons of neutral tonnage obtained by British coal pressure, etc., forced into her service.

The total tonnage in service of France in 1918 was of:—

	Tons gross
French National tonnage	1,600,000
British and other tonnage	1,700,000
	3,300,000

Italy.—Italy had the equivalent of over half a millions tons gross of British shipping in her service.

About 45% of her total imports were carried in British ships.

75% of the coal supplied to Italy was carried in British ships.

462,000 tons of cereals out of 936,000 tons in all were carried to Italy in three months alone in British ships.

Italy had the benefit of coaling stations supplied by British tonnage.

300,000 tons gross of neutral tonnage obtained by British coal pressure, etc., was in her service.

The total tonnage in service of Italy was:—

	Tons gross
Italian National tonnage	1,075,000
British and other tonnage	1,000,000
	2,075,000

America.—And now let me tell you what we did for the United States of America.

In the Spring of 1918, it was the intention of the U. S. A. Government to send 120,000 troops a month to Europe, of which number the British Government undertook to provide shipping for 60,000 a month, which was considered to be the maximum number which could be transported without imperilling the the food and munition supplies of the Allies.

The German advance in March, 1918, altered the position, and the U. S. Government undertook to send their troops as fast as shipping could move them, Great Britain agreeing to provide every possible ship suitable for the conveyance of American troops, irrespective of the risk to the food situation.

This necessitated almost a complete revision of the convoy system, and a reshuffling of the world's tonnage. All suitable ships from other routes were diverted to the Atlantic, and the slower unsuitable ships for the Atlantic were taken from that route.

The numbers of U. S. troops moved in British ships to Europe in the immediately succeeding months were:—

May	147,861
June	156,940
July	188,585
August	180,135

Thereafter the numbers fell off on account of the influenza epidemic and the non-availability of troops, but in all, over 1,000,000 troops were conveyed from the U. S. in British ships during 1918.

The extent of the sacrifice involved will be appreciated when it is realized that 124 additional ships were put into service between March and August, and that on the average every American soldier carried, shut out two tons of essential cargo.

In addition to the above, America had an average of 500,000 tons of British shipping in her service during 1918, the American Army was supplied with very large quantities of imported timber, munitions, etc., and the United Kingdom co-operated with the U. S. A. in obtaining neutral tonnage by which means America obtained nearly 1,000,000 tons of neutral vessels for her own purposes.

For our other Allies, Belgium, Greece, etc., there was also much sacrifice.

I have not so far told you of the reduction in British exports during the years of war. Unfortunately figures in weight are not available and I refrain from giving values, as they are so misleading. The reduction, however, was enormous—probably two-thirds.

These figures convey some slight indication of what was accomplished by British shipping.

When we look back on these anxious days, one wonders how it was all done, but Britain gave up everything for the war, and its Mercantile Marine bore a tremendous burden. Without it, humanely speaking, the war could not have lasted beyond a few months. Not only was Great Britain incapable of maintaining its people from its own home products, but as we have shown, all our Allies became dependent upon British shipping for remaining in the war, by making the supply of their necessary requirements possible.

One is often tempted in these days to think that some of our Allies have too soon forgotten all that this country of ours did for them. It does not appear too much to say that British shipping was the key of the situation, and that without Britain, more especially some of our early Allies would quickly have gone down before the enemy and probably have become third or fourth rate powers.

After the Armistice in November, 1918, the demand for British shipping continued for a considerable period almost as great as during the war. Tonnage available was far short of needs. Armies, horses, and millions and millions of stores of every character had to be moved.

Between the Armistice date and 31st July, 1920, in personnel alone there was carried:—

From France to United Kingdom, British and Imperial troops (including leave men)	3,248,196
From Mesopotamia, Salonika, India, etc., to United Kingdom, British and Imperial troops (including leave men)	289,525
From France and other theatres to United Kingdom, British and Allied Invalids	253,489

From Germany, Holland, etc., to United Kingdom, Prisoners of War	165,994
From United Kingdom to various theatres, British and Imperial troops	1,649,961
From United Kingdom and France to Canada, Australia and New Zealand, Troops and Families	312,483
From United Kingdom and France to U. S. A., American Troops	141,843
From France to China, Chinese Coolies	89,958
From Basra and Egypt to India, British and India Troops	299,841
From Vladivostock to Europe, Czecho-Slovak and other Allied Troops	22,734
Other moves, Miscellaneous	1,164,875
	7,868,763

Although the numbers thus carried after the Armistice were not quite so large, the work of carrying was in a sense greater. This was due to the fact that the repatriation of the armies involved a heavier proportion of long journeys, and the number to be moved included large numbers of women and children, who occupied proportionately more space aboard ship than troops.

It is specially worthy of note, that within 12 months after signing of Armistice, the repatriation of the colonial forces was practically completed, although the maintenance of armies of occupation at various places and the replacement of the war personnel by the post-war personnel still involved large movements of troops by sea.

Immediately war ceased the general requirements of the country had the fullest consideration.

Notwithstanding all the Government requirements, it was a matter of great satisfaction that within a week or two after the Armistice, it was made possible for practically every British Line to resume operations, and the old flag was quickly again flying on every sea.

True, certain other nations had not failed to take advantage of the difficulties of Great Britain during the war, and started lines to secure what had been British trade, and unhappily, a number of those still remain.

I now come to shipbuilding.

I have no doubt it will specially interest this meeting to have some information regarding the shipbuilding programme in connection with the British Mercantile Marine, carried out during the war, and also its after disposal.

Standard Ships

When early in 1917 the Government entered upon mercantile shipbuilding, it was decided to immediately proceed with cargo-carrying ships which could be completed in from six to eight months, and to inaugurate a programme of standard ships, plain cargo boats designed to be built in the quickest time with a minimum expenditure of material and labor.

Differences of opinion existed as to the advantage of a programme of standard ships, yet on the whole shipbuilders loyally accepted the position and put their facilities at the disposal of the Government, or in other words, they did as a matter of fact, sub-ordinate their private interests to what was regarded to be the public good, although in one or two instances, shipbuilders did not think it was to the public good.

The advantages of standardization as a war emergency measure are found in the fact that there was only a limited amount of labor and material available, and that by reducing the sizes of sectional material to be used in the building of ships, the labor involved was reduced: for instance, a cargo-carrying ship of 8,000 tons d. w. had before the war, something like 30 to 40 different sizes of sectional material in her hull. The standard ship of the same dimensions had only eight to ten, and these sizes were made available, not only for this size of ship, but also for other sizes as well. In other words the naval architect designed the standard ships in accordance with the sections which were available, and which were interchangeable. In addition to this there was, of course, standardization of auxiliaries such as deck fittings.

The main advantage to be gained was, however, in the standardization of the engine. Whereas, previously, each hull had its own particular type of engine, and, consequently, oftentimes hulls were waiting for as long as six months before the engines were completed owing to precedence of naval work and other work in the engine shops, the adoption of a standard type of engine made it possible to place the engine in any hull of the type for which it was intended. This actually occurred, the machinery allocated to one particular ship being changed over to another ship of which the hull was completed first.

The original programme of standard ships arranged for five types to meet the national needs. These five types, although of varying sizes, were fitted with only two types of engines and boilers. The advantage of this is obvious.

821 vessels were ordered by the Government in the United Kingdom and abroad, not including those ordered in the United States, to which reference has been made. Of those, immediately after Armistice time, 279 were transferred to private owners before completion, without financial gain or loss to the Government. 126 contracts were cancelled, involving expenditures by way of compensation of about £500,000. The remaining 416 vessels were completed to the order of the Government. Of these 23 were lost by war and marine risk, 15 were transferred to Admiralty service as oilers, and the balance of 378 were sold to private owners.

Of the vessels sold, 311 ran on Government account for an average period of 12 months prior to sale, the remaining 67 being sold during construction and taken over by the new owners on delivery by the builders.

These vessels helped materially to meet the increasingly urgent demand for tonnage in the latter stages of the war, and had they not been built their place could only have been filled by the securing of any free vessels which might have been available. Practically all British vessels were already under requisition, and it would have been from neutral sources only that any considerable amount of tonnage could have been obtained. The construction of the standard vessels, therefore, enabled a very large saving to be effected in hire money. The minimum saving, if calculated on Blue Book Government rates, and the more probable saving at neutral rates, would work out thus:—

Saving in hire at Blue Book rates on—

311 vessels for 1 year. Estimate	£11,000,000
311 vessels for 1 year at neutral rates	£27,000,000

or 43% of the total cost price of the 378 vesels built.

Thus concluded the shipbuilding programme of the Government after the war. Perhaps the American policy with its disastrous results has somewhat influenced me in giving these details.

Let me now refer to the manning question.

Recruiting from the Mercantile Marine

A large number of Admiralty owned ships and certain merchant ships on special service were manned by Mercantile Marine ratings, who accepted Naval discipline. The figures are not available for later dates, but as early as January, 1916, the number of men in service on this basis was officers, 1,108; engineers, 2,349; ratings, 17,454.

In the Mercantile Marine itself it is estimated that the maximum number of ratings during the war was between 190,000 and 200,000, and that the total number employed during the course of the war was about 300,000.

The number of lives lost by enemy action at sea between 4th August, 1914, and 31st December, 1918, was:—

At sea	15,555
Killed by bombs	4
Executed	1
Died in internment	69
	15,629

In addition, 6,331 passengers lost their lives at sea by enemy action.

An interesting event, an exciting one to those directly engaged, was the removal of ships from the Baltic.

At the time of he Bolshevik revolution there were in the Baltic 67 steamers of a total gross tonnage of 151,258 tons, 53 of these successfully ran the German blockade at the entrance to the Baltic and reached the United Kingdom, and formed a most acceptable addition to British shipping.

General

I think to-night you would wish me to say something of the possible future of our great shipping industry.

What the future has in store one would not venture to prophesy. Happily the British shipowner is a born optimist, otherwise he would at present be a very anxious man.

It is not essentially because of profits that Britain has for so long taken the lead in the shipping world, as from a financial standpoint shipping has been less lucrative than many other forms of investment. Good years do come, but these are comparatively few compared with lean years. The fact is that the sea is in the blood of the Briton, and he loves it as no other nation does.

At present the world is faced with a superabundance of tonnage and greatly restricted trade.

When war broke out in 1914, the total gross tonnage of British steam vessels of over 100 tons gross amounted to 18,892,000 tons, and the sailing tonnage to 365,000 tons. Including the Overseas Dominions, the tonnage owned in the British Empire amounted to 20,524,000 tons of steam vessels, and 521,000 tons of sailing vessels, while the steam tonnage controlled by other nations aggregated 24,880,000 tons of steam vessels, and 3,164,000 tons of sailing vessels.

At the end of June, 1921, the latest date for which figures are available, notwithstanding the restricted output in the United Kingdom during the war, British-owned steam tonnage amounted to 19,320,000 tons, or, including Overseas Dominions, 21,589,000 tons. These figures include over a million tons of ex-German ships allotted to Great Britain. At this date (June, 1921) the sailing tonnage belonging to Britain amounted to 252,000 tons, the total for the British Empire being 482,000 tons.

The tonnage possessed by other countries at same date amounted to 37,258,000 tons of steam tonnage, and 2,646,000 tons of sailing tonnage, so that since 1914 the amount of steam tonnage under all flags has increased by 13,442,000 tons by June, 1921. After making allowance for ships constructed during the last quarter, the world's total of steam tonnage on the 30th September, 1921, is probably about 59,000,000 tons—an increase of about fourteen million tons.

Further it is estimated that there is at present building in the United Kingdom about 3,283,000 tons gross of steam vessels (including 1,188,000 tons, the construction of which is either postponed or delayed), and in other countries about 2,210,000 tons, including about 375,000 tons on which work has been suspended.

While the amount of tonnage has thus largely increased, trade has greatly decreased. Imports into this country in 1913 amounted to 56,023,000 tons, while exports amounted to 93,624,000 tons. In 1920 imports amounted to 45,542,000 tons and exports to 41,175,000 tons. As with Britain so has it been with other European countries, but in some the reductions have probably been considerably greater. In this country there are hopes of improvement with falling prices and larger output, but for some time to come Russia, Germany and Austria must of necessity be small purchasers, while the spending power of our late Allies (France and Italy) must be greatly restricted. In all other countries there is also serious difficulty with finance and exchange, and a considerable period must elapse before the world can get back to anything like normal conditions.

It meantime looks, so far as shipping is concerned, as if it must be a case of the survival of the fittest, but with a free field and no favor, the British shipowner need have little fear.

Since the war period, the delays in ports have been excessive especially consequent on labor restrictions, but those are gradually being overcome, and will, it is hoped, soon very much pass away.

Increase of coal export would probably help the shipping position of this country more than anything else. Before the war, comparatively few ships left the United Kingdom without outward cargos, which paid a very considerable portion of the cost of the working ships, in many cases round about two-thirds, whereas to-day, especially for tramp tonnage, outward freights are almost unobtainable, and in consequence, British imports are being carried by tonnage which has to proceed in ballast to loading ports, thereby throwing the full cost of shipping on our imports and enormously increasing the price of raw material.

The British Empire depends on its shipping, and it is to be feared that if Britain loses her position on the seas, it will be together with the decadence of the Empire.

Some nations are legislating and threatening legislation which may seriously affect British interests, and it is the duty of our Government closely to watch other countries, if our Mercantile Marine is to prosper in the future.

Nothing could have been more fortunate for the British Empire than the fact that for a period, handsome profits were made by shipping companies, as otherwise to-day, money would not have been available for the reinstatement of fleets which were desolated during the war.

Building prices continue high, and are probably still round about three times pre-war figures. The result is that the giving of orders has practically ceased, and only after prices considerably recede can there be any hope of renewed prosperity for our shipbuilding yards.

Oil Fuel and Diesels

A wonderful development has taken place in recent years in the use of oil fuel by steamers. In 1914 only about 350 burned oil, whereas something like 2,600 are now fitted.

It may be that this development may help the adjustment of the shipping position in the not distant future, and more certainly so if the new Diesel engine, for which so much is claimed, proves to be a success.

The whole question, however, of cost of production must be carefully considered by masters and men together, if Britain is to continue to hold the first place in the shipbuilding and engineering of the world.

During the war period, when the blood of Britain's sons of all classes flowed together and countless thousands filled common graves in foreign lands, the sympathy between all sections of our people was deep and real. Unhappily, influences have since come in which seem somewhat to have checked that sympathy, but notwithstanding, there is, I believe to-day, a widespread and growing desire among all classes to work together in harmony. What is good for one should be good for all, and the war has not served its full purpose, if it has not taught all of us to have greater thoughtfulness and consideration for the interests of others.

Gentlemen, I have finished.

I trust that in the years to come, the society under whose auspices we have met to-night will continue its useful services to the community, and will flourish even more than in the days which are past.

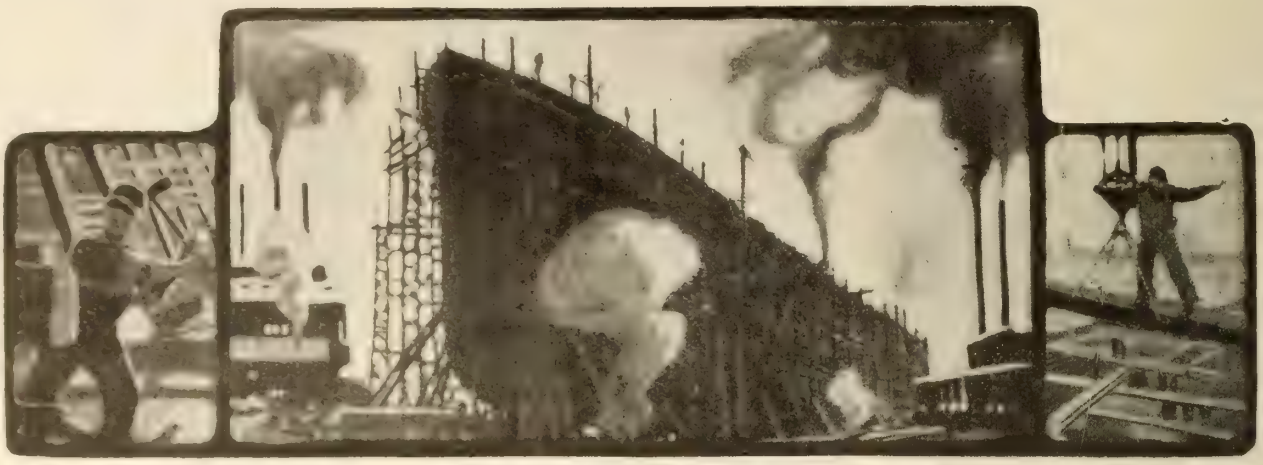
NEW USES FOR RUBBER

A very interesting competition was recently organized in Great Britain. Prizes were offered for suggestions for novel uses of indiarubber. About 10,000 suggestions were sent, and the first prize was awarded for the suggestion for using sponge rubber for general upholstering purposes, including the making of mattresses. Another prize suggestion was that rubber should be included in liquid form with paint or other composition for use in the preservation of wood and metals against the action of the sea. A third prize was given for the suggestion that rubber should be used for general decorative and preservative purposes. These and other suggestions are likely to create important new departments for British manufacturers.

NEW OIL GAS BURNER

A demonstration was recently given in London, England, of a new type of burner for use with oil. The oil is first converted into gas in a chamber filled with nickel gauze heated by the flame. The oil gas then passes through a regulating valve and issues as a jet which carries with it the air required for combustion. The mixture then passes into another chamber, where it is still further heated; and it issues from orifices arranged according to the services required. No carbon forms in the burner, and it does not require cleaning. This invention can easily be adopted either for heating or for lighting in conjunction with an incandescent mantle.

Looking Over the *Shipping* Situation



By F. H. FENNER, Editor Marine Engineering of Canada

ONE year ago the writer opened a similar article by saying that shipping in general was in the doldrums, and sad to relate it has remained in the same desolate trade region during the intervening period. Shipowners and shipbuilders, like the old sailing ship men who were becalmed, are still whistling for a wind that will fill their sails, and carry them into the path of the full trade winds, but there are few signs of such a desirable breeze approaching. There have been zephyrs and ripples on the surface of the calm sea, but they have proved to be the lightest puffs, which died down before they had imparted any way to the vessel. Hope, which springs eternal in the human breast, is fortunately still lending its spreading wings to the minds of those becalmed, and giving them the necessary encouragement to face the situation with fortitude. The writer shares the hope that if he is called on to write on shipping one year hence, his introductory words will not be so lugubrious.

From the beginning of 1921 the returns of ships under construction have shown a steady falling off in point of tonnage, and even the tonnage shown in the tables was misleading, as a large amount of it was under suspension. That is, after a certain stage of completion had been reached, further work was stopped. A large number of contracts were cancelled, large sums being paid in default, owners feeling that it was better to take a known loss than to continue building ships at high capital cost when the freight market was rapidly falling.

Added to this the strike of the ship joiners in the British yards held up an enormous amount of tonnage, and made a bad situation worse. In this general period of depression, the liner companies kept steadily on at their building programmes, made necessary by the losses sustained by their fleets during the war. The class of vessel that was chiefly affected was the tramp or general cargo boat of medium tonnage. This of course was perfectly natural, as these vessels usually run on a small margin, and high capital costs would be fatal to their chances of paying a dividend to their owners. The fleets that were being built for the United States and Canadian Governments were of course continued with, the fact of being able to pay for themselves or otherwise, not being a consideration when the whole country had to pay for them. These fleets are now about completed and shipbuilding in both Canada and the States has arrived back at the position it held before the war blew it up to such inflated dimensions.

State of Shipping Trade

There is no better barometer of the state of the shipping trade than price of ships in the open market. A couple of years ago anything that could float commanded a purchase price of from $175 to $200 per ton, and even on such a large capital expenditure, could still pay high operating costs and make a good profit. To-day, vessels that actually changed hands for prices such as mentioned above, are being sold, where a buyer can be found who has a special use for them, for the sum of $30 to $35 a ton. Probably no other line of merchandise or manufactured goods can show a drop approaching this, in values. Further, there are almost no buyers even at this low price unless it is, as before mentioned, for a ship to put on some special route or for a special purpose. This drop in value means to the people of Canada that the fleet they

The motor ship "Malia" fitted with opposed piston two cycle Diesel engines of the Fullagar type.

have invested some $70,000,000 in, is at present values only worth about $10,000,000 or would be if it was still all afloat. The vessels lost will of course be replaced in value by the insurance carried, that is the amount necessary to repurchase a ship of the same size at the prevailing prices would be paid to the owner, in cases where a total loss was incurred.

Whatever the amount received for the vessels lost, it will have little effect on the general value of the whole fleet, which is not influenced by whether the ships are privately or publicly owned, what flag they are under, or any factor at all except their value in the open market. For the next few years competition in the ocean transportation business is going to be of the keenest, and it will be a question of "sauve qui peut." There are many thoughtful men who think it would be a good plan to cut the losses, and dispose of the Canadian Government fleet at the most advantageous terms to be obtained, rather than continue operations at great loss to the country. There are others, and notably in the inland provinces, who feel that anything owned by a Government, or rather publicly owned, is possessed of certain inherent virtues, which make it worth while whatever losses it involves its owners in.

All the maritime nations have increased their shipping since the armistice, and it is interesting to note that the Germans are once more coming into the scene as active competitors on the sea lanes of the world. They have been conducting a joint service between Germany and the U. S. with the Harriman lines, using American ships. Quite recently an old arrangement existing before the war between British and German lines trading in the far East has been renewed, and the Germans will be able to man their part of this joint service with their own ships.

The Latest Figures

The latest returns of Lloyd's Register of Shipping tell the story of the decline in shipbuilding better than any other single factor. In December 1920 the total tonnage under construction in the world was, (excluding all vessels under 100 tons and war vessels), 7,179,779 tons, which was divided up between 1,640 steamers, 189 motor vessels, and 151 sailing vessels. The United States at that time had under construction 1,310,312 tons, of which 1,278,020 were steel steamers, the rest being motor vessels and sailing vessels both wood and steel. In Canada there were under construction 127,862 tons of steel steamers, and a number of wooden and steel sailing and motor vessels that brought the total up to 136,759 tons. The total tonnage under construction in the United Kingdom was 3,708,916 tons gross, while the total tonnage building outside of the U. K. was 3,470,862 tons.

The latest figures available, which are those for the quarter ending September 30th, 1921, show a falling off in figures, but the actual falling off is greater than the figures show. This is on account of the large amount of tonnage on which construction has been suspended. The total tonnage under construction in the United Kingdom at the date above mentioned, was 3,282,972 tons, while the total for the whole world was 5,542,978 tons. These figures, of course, in both cases exclude Germany, the latter not being available, but would have little influence on the general total. This shows a falling off of 1,636,821 tons, but when the figures for tonnage under suspension are considered the loss is much greater. There is in Great Britain a total of 1,188,000 tons, on which work has either been suspended or completion postponed, while abroad there is a total of 375,000 tons suspended. This materially reduces the figures which may be considered to represent work actually under construction, bringing it down to 3,979,978 tons. The tonnage under construction in the United States is at the date under consideration only 433,962 tons, which is composed of 403,362 tons of steel steamers, the rest being divided between steel and wooden motor and sailing vessels.

Canada had under construction only 67,255 tons steel steamers, and before the December quarter is reached, most of these will have been completed. It is interesting to note that outside of the United Kingdom and United States, the principal countries engaged in building ships are Italy, France, Holland, and Japan. Japan has the least tonnage of the four named, about 190,000 tons, while each of the others have just a little under 400,000 tons under construction. There are a large number of vessels of the special class built for carrying oil in bulk under construction, 81 of which are being built in Great Britain, and 28 in the United States. There are over 400,000 tons building which are to be fitted with internal combustion engines. The tonnage building in the United Kingdom is 59.2 per cent. of the total, which is getting back to where it used to be. However, the proportion of work completed to work commenced is very low, and it is this feature, combined with the absence of any new orders, that makes the outlook so bad.

Labor Troubles

Great Britain has suffered more from labor troubles in the shipbuilding trade than any other country during the past year, and the stubborn attitude adopted by the men has resulted in the loss of millions of pounds' worth of work. To make it all the more annoying, some of

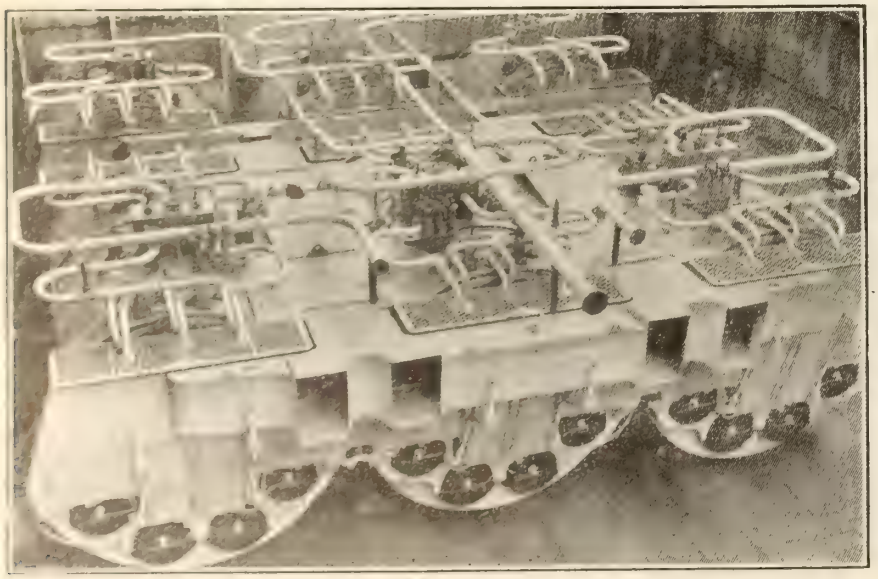
A typical British cargo liner.

this work has actually gone to our recent enemies, while in other cases the cost of ships has gone up very considerably from the first estimates. One of the worst strikes has been the ship joiners. These men went out on strike as a result of a proposed reduction in wages to allow the builders to compete. The cut was accepted by the other trades concerned, but the joiners refused to consider it. There happened to be a lot of work in the house-building trade and the joiners were readily absorbed in that. Not so the rest of the trades, who were thrown out of work by the action of the former. Many ships that were to be repaired and reconditioned were sent to Rotterdam, Antwerp, and even Hamburg because their owners needed them and could not take a chance on the delay in getting them into service again that would result from the dilatory tactics of the labor unions.

Many vexatious restrictions were stubbornly adhered to by the men in different trades, and thousands of men were walking about drawing unemployment doles as a result. One instance in point was the case of the boilermakers in the Liverpool district, and their objection to the use of the oxy-acetylene torch for cutting plates. They did not object to the torch, but demanded that when it was used the same number of men should be employed to do the cutting as when it was done by hand, and those men not handling the torch should stand by while the work was being done and draw pay for it. They hung out for a long while on this untenable position, but have finally capitulated. The joiners' strike has at last been settled, but things have come to such a pass that it will be a long time before there will be employment for them and their fellow workmen. The prime necessity in Great Britain is cheap coal, and until coal comes down to a price where steel makers can compete with other countries, there will be more or less stagnation in the shipbuilding and allied industries. There is one good sign, and that is the increase in production of coal, and the fact that Welsh coal is once more being shipped to the foreign markets where it once reigned supreme.

During the coal strike in England and Wales, American coal found its way into European markets, and even South African and Australian coal was shipped to the same quarter, but naturally, this could not be expected to continue. The American coal dealers, assisted by the U. S. Shipping Board, tried very hard to establish a firm footing, but with coal being produced at anything like the same price in England and Wales, it is an impossibility for them to compete. The French Government after hanging fire for as long as possible in order to benefit by any further reduction in price, has at last given orders for their supply of Welsh coal for the railways. Other European buyers who had fairly large stocks on hand are making enquiries. The miners seem to have made up their minds to work and in this is the most hopeful sign in the whole industrial outlook. As the writer has pointed out before, cheap British coal is a stimulus to the whole industrial world of Europe.

When European buyers can get this vital necessity at a price that makes it possible for them to run their factories at a reasonable cost, they have goods to interchange with each other, and Britain has cargo for her ships, and cheap raw materials for her factories. She has also cheap coal for her blast furnaces and her shipbuilding and engineering industries, so that she in turn can export manufactured articles in exchange for food stuffs, raw cotton, jute, fertilizers, ivory, rubber and the thousand and one things needed by a population of forty millions odd in a highly civilised country. One of the important trades is the ore trade from the coast of Spain, in exchange for coal from the coast of Engand, and this market has shown some improvement. The situation was admirably summed up recently by no less a person than Lloyd George in this way, "It is not summer, it is not even spring, but the extreme rigor of winter is passing." That description might be fittingly applied to the industrial situation in Canada, as apart from the shipping situation itself.



The boilers and steam pipe layout of the new Cunard liner "Laconia."

Canadian Shipping and Shipbuilding

Canada has always had a certain amount of shipping flying her own flag, and, as is well known, had at one time a very considerable wooden shipbuilding industry. This, of course, like the wooden ship industry in the U. S. was wiped out when Great Britain started building iron steamers, and captured the lion's share of the shipbuilding trade of the world. Although Canada has on her eastern coast very fine deposits of coal and iron, there does not seem to have been any effort made to establish a shipbuilding industry in the logical place for it till recent times. Of course, the earlier Canadians were more occupied in railway building, and agriculture, and the maritime provinces were more or less neglected for a long time. The higher cost of labor in Canada also militated against it. Whatever the causes, shipbuilding in Canada languished, with the exception of two or three yards on the Great Lakes, and one on the B. C. coast, till the war came along with its demand for ships, ships, and more ships. Then it was that shipyards sprang into existence overnight, almost. The first stimulus was given by the Imperial Munition Board, which carried out a program of building that amounted to about $70,000,000, and this was followed by the Canadian Government program of 63 ships, costing about the same or a little more. In addition to these two programs, a few ships were built to foreign order. A number of shipbuilding yards were started by contractors and others totally unused to shipbuilding, and when the rush subsided these yards naturally were the first to subside also.

The shipyards mentioned in the official report of the Department of Marine and Fisheries for the year 1915-16 covered just six firms. Of course there were really more than that, as there are always a number of little yards building schooners, etc., down on the N. S. and out on the B. C. coast but these six yards were the only ones that could really be designated as shipbuilding yards. In the following year's report there are ten yards more deemed of sufficient importance to be mentioned specifically. There were several fairly large yards which for some reason did not seem worth mentioning in the Government reports, but at the height of the boom, there were about twenty yards engaged in the building of steel and wooden ocean-going steam tonnage. This takes no account of the schooner builders of the Maritime Provinces, of whom there were literally hundreds. The Government were much impressed by the apparent permanence of this shipbuilding industry, and accordingly made arrangements to subsidize the Dominion Steel Corporation at Sydney in the erection of a plate mill which could roll plates and shapes for ships, eliminating

the need of importing these very necessary components of steel ships. They even made a contract with the company to take a large quantity of plate per annum over a period of five years from the completion of the mill, the contract being placed at the then high rates. Everyone in Canada seemed to approve of the Government's action at that time as being the best thing possible for the country, but in the light of events that have since happened, they are expressing doubts. Some of them are even saying that they knew all along that it was a mistake.

The writer has always held the opinion that there is room for a certain amount of shipbuilding in Canada, and that a steel company situated right on top of all its own material, as the Dominion Steel Corporation is, should be able to produce as cheaply as anyone in the world. There is no reason why in normal times the mill could not get some of the foreign orders that are going, and probably in time the action of the then Government will be justified, as far as the plate mill is concerned. As regards the shipbuilding industry, the Minister of Marine, through the departmental report, made mention of the fact that the Government's shipbuilding contracts would carry on until 1920, by which time the industry would be on a firm footing. As it happened, further contracts were let which carried on the work until 1921, but without the desired effect of putting the industry on a firm footing. As far as many of the yards were concerned there was no chance of them ever being on a firm footing, and it was just as well that they should disappear in the ordinary way of commerce.

There are, however, several husky survivors in existence to-day, whose foundations are firm, and who will tide over the intervening time in safety, and be ready to carry on when business resumes its normal activity. The writer has never had any fear for yards that are situated on tidewater, and have graving dock facilities as well as shipbuilding facilities. The same applies to the old established lake yards, which are well provided with repairing facilities. These yards can generally be depended on to carry on a profitable career even if they never built a ship. Yards on the other hand, that were erected purely and simply to build, and equipped with machinery purchased at war prices, and often built on land that cost war prices to acquire, had but little chance of living under ordinary competition. When it is further considered that the guiding hands in many cases were utterly unfamiliar with shipbuilding, it was but natural that they should fade from sight. The shipbuilding boom is over for Canada, leaving in its trail practically all the yards that were here before it arrived, and having ended the careers of most of the new ones.

When it comes to the ships themselves a different case is shown. Canada is, in this case, still in possession of all the ships that she built to create a merchant marine, with the exception of those that have been lost by perils of the sea. These include the "Canadian Recruit," which was unfortunate from her early days, and "Canadian Exporter," which are total losses, while the "Canadian Importer" will be repaired.

In the report of the Department of Marine for the year ending March 1916, it is stated that it had formerly been the habit to value ships on the Canadian Register at $30 per ton, but owing to abnormal conditions, this price was much lower than the actual price prevailing which was from $75 to $100 per ton. It also stated in this report that there had been much agitation for the creation of a purely Canadian Mercantile Marine, and that in this connection, it should be borne in mind that the day of the small carrier had gone. The most efficient vessel was one between 7,000 and 10,000 tons deadweight. This is interesting to note in view of the class of ship that was actually built for Canadian merchant marine, at a cost of practically $200 per ton.

Of the total number built there are no less than thirty-one which are under 5,000 tons, while there are nineteen of these under 4,000 tons, and three of them under 3,000 tons. There are but two ships of 10,000 tons or over and twenty-one of 8,000 tons or over. The value of all these ships in the open market is now about what it was before the war, that is about $30 per ton. Of the vessels building in the United Kingdom at the present time there are out of a total of 633, no less than 366 over 4,000 tons deadweight, and the remainder include a number of small craft for strictly local trades and coasting vessels. For ocean-going traffic, a vessel of under 7,000 tons deadweight capacity is not a good proposition, the reason being, of course, that operating costs are out of proportion with the larger vessels.

Engineering Development

The development in the marine engineering world has been, as it has for some time past, along the line of motor-driven vessels, coupled with a further application of the geared turbine. One vessel was built in the United Kingdom with electric drive, but this vessel was for an American shipping concern. The electric drive has not found favor with the British shipowner, although it is being adopted in the U. S. both in naval and merchant fleet construction. A discovery that is expected to considerably widen the knowledge of propelling problems is a method of getting the actual thrust developed by the propeller at the thrust block of the ship, something that has not hitherto been available. The method is by using a number of cylinders, grouped round the Michell thrust block, which receive the thrust in of the propeller on diaphragms, which transmit the pressure through oil pipes to gauges, on which the actual thrust in lbs. per sq. inch is registered. Much more accurate knowledge of propeller performance can be obtained in this way, and improvements in design will follow. Opposed piston two cycle Diesel engines have been developed further, and in one particular case which marks a radical departure, had been tried out in a coasting steamer, and have now been fitted in an ocean-going steamer, an illustration of which is given here. There have been several large liners converted to the use of oil fuel during the year, including the "Aquitania" the "Mauretania" the "Olympic" and the "Empress of Britain". Another development in engineering which has been applied so far to only small coasting steamers, fishing boats, etc. is the Kitchen rudder, an apparatus which enables a steamer or motor boat to perform all the maneuvers of going ahead or astern, at any speed desirable, at the same time steering in any direction while the engines maintain a constant speed. This is especially useful in the case of small craft, such as tugs and fishing boats, as all the manoeuvering can be done by

Dry Dock of the Halifax Shipyards.

the navigating officer, without the interposition of the engineer. The makers have gone slowly, and are gradually applying the apparatus to vessels of larger size, and it is quite within the bounds of possibility that it may eventually be applied to the largest. The more extensive use of oil for fuel and for internal combustion engines has led of course to a larger demand for oil tankers, and there are a large number of these vessels being built. The latest returns of Lloyds give a total of 140 of these tankers as being under construction throughout the world, of which 81 are being built in Great Britain and Ireland.

The U.S. Shipping Board Fleet

The past year has been a disastrous one for the great fleet of our neighbors to the south, and has witnessed considerable upheaval in the shipping board control. Following the general charges of graft and incompetence that were made against the original shipping board, a new board was appointed, with a new chairman, Mr. A. D. Lasker who was at the head of a large advertising agency but not by any means a shipping man. The rest of the board were just as inexperienced as the chairman in shipping matters, but before they had been very long in office they called to their aid three well known shipping men in the U.S. to assist them in the management of the national white elephant. The fleet during the year has been losing money at the rate of $300 000,000 per annum, but now that the wooden ships have all been got rid of, for the price of about one of them, the losses will be cut to some degree. These wooden vessels were costing no less than $135,000 per month to keep in idleness, so that getting rid of them at any price was a good move. A leading American shipping paper came out boldly with the suggestion that the whole fleet, wooden and steel as well, be taken to sea and sunk as the easiest way out of the mess, but naturally so drastic a course was not looked on with favor. One of the latest methods of trying to get the ships into use has been to offer them to private owners at a charter rate of $1 per ship per month, the board to carry all insurance charges. So far there has not been time to see how many private owners want them at that rate. The trouble with the U.S. fleet of course is that they cost more to operate than any vessels afloat, and furthermore there is ample evidence from reliable sources, that the operation as well as the management has been woefully inefficient. The United States is not a maritime nation any more than Canada is, and any artificial attempts to make it so are liable to be a failure. As Sir Joseph Noble, a well known shipowner, said recently, the growth of the British merchant fleet has been a slow one, extending over 200 years, and a result of the initiative and courage of traders, shipbuilders, shipowners and engineers. He further says, "These facts should give us confidence when we are inclined to fear the competition of friendly rivals who are actuated by sentiment more than actua. need." This phrase surely applies to the United States, and in a lesser degree perhaps may be applied to Canada, who could hardly be conceived to have an overpowering need for a merchant navy.

The Shipping Board has on one or two occasions during the past year attempted to get cargoes for ships by shaking the big stick of the Jones Act, which ill-considered piece of legislation has never been put into force. One of these cases was the Egyptian cotton incident, when the Shipping Board demanded that all cotton cargoes from Egypt to the U. S. should be given to their steamers. They actually quoted much lower freight rates than the lines in the British conference, but the shippers had such little confidence in their ability to handle the cargoes successfully, that they refused to give them any cargo. The Shipping Board agent and the American consul then resorted to threats of discrimination against cotton coming into the U.S. by British ships, and there was almost an international incident over it, until their over-enthusiastic officials were called off by their Government in Washington.

The General Outlook

The outlook for the shipping fleets of the world is at present not very bright, as the world-wide depression naturally affects ships about as quickly and as severely as it does any other interests. The exchange rate, which militates so largely against international trade, prevents the ships having full cargoes to carry. The increase in the world shipping totals is not such a serious factor as some would have us believe, for while there has undoubtedly been a large increase, a great deal of the tonnage comprising it is of ancient vintage, and not suitable for modern use. With a revival of trade a good deal of this shipping would be removed from the register, and replaced by more modern tonnage. The liner fleets are busy bringing their fleets up to pre-war efficiency, one of the most notable being the Cunard, which has something like a dozen of the most up-to-date type of liner under construction, the first of which, the "Scythia," has been placed in commission. These sels are of the intermediate type, that is they combine large carrying capacity with a good amount of passenger accommodation and a reasonable speed. The liner de luxe is not being built. Tramp shipping, which plays such an important part in the well-being of Great Britain, is largely tied up, but as mentioned before the revival of demand for Welsh coal by foreign buyers, will give a welcome stimulus to this class of vessel. Exportation of coal will also help to bring the pound sterling back to normal again, and revenues from outward and homeward freights will be swelled. In this connection, it was estimated by a very high authority that the value of the invisible exports, which is how freight revenues are described, before the war, was £100,000,000. This is what the British mercantile marine earned without the values of the cargoes that they carried out with them, and the raw materials they brought back with them.

It is a rash man who would make any prognostication of the trend of future events, in the light of the performances of the past couple of years. As far as Great Britain is concerned, she is bringing her fleet up to efficiency as fast as she can, beset with labor troubles and general depression as she is, and will no doubt be found when the revival comes with at least her fair share of the world's carrying trade. Other countries, notably France, Italy, Holland and Japan, have increased their merchant fleets considerably but Japan, at least, has suffered some heavy losses with the decline of the freight market. The United States have a fleet on their hands which has cost billions of dollars, and the prospect of it ever being an asset to them is doubtful. Canada has also got a fleet on her hands, and how much the past year's operations have cost us we do not yet know. It has the benefit we believe of competent management, but in view of its high capital cost, and that it can only obtain the prevailing freight rates, it is doubtful if it can be expected to carry on without heavy losses. It has to compete in the world market. It has, like other properties owned by the people, the constant danger of being experimented with by any new set of politicians who happen to get elected, and in view of this the taxpayer cannot view his ownership of a fleet with anything like equanimity. He still has the privilege of hoping. As Mr. Ballantyne sorrowfully confessed, "the Canadian manufacturer does not seem to be availing himself of the opportunities to create new export markets which the fleet affords." There is little chance of any route being neglected by private owners where there is any hope of a return, and it is very doubtful if the C.G.M.M. will have much success in its efforts towards creating new trade fields.

It has been seriously mooted by a member of the Shipbuilders and Engineers in Scotland that in the coming few years it will be impossible for any vessel driven by power alone to make a living, and he has suggested that the solution is the motor-engined clipper schooner. He proves his case by means of curves taken over a period of a couple of thousand years. Other authorities insist that the worst is over, and several large British shipowners say it is entirely a matter of labor settling down to work in order to bring prosperity back. There are various theories. The simple fact seems to be that we are slowly recovering from a time of abnormal conditions, and the period of adjustment is longer than it was expected to be. Probably a good deal of the trouble is due to artificial restraints of trade in the form of high tariffs that have been introduced in countries where formerly there was free trade, such as has happened in the newly created states of Europe. The Fordney Bill in the U.

S. is a good illustration of creating artificial restraints of trade.

However, that is perhaps verging on dangerous topics. We must go on in the most efficient manner possible, getting the production of costs of goods down to a point where they meet the purchasing power of the people and leaving them a bit of money over to buy some of the little luxuries of life. Lower railway rates will have their effect on trade, as lower coal prices are having their effect in Great Britain, and gradually we shall emerge from this valley of unrest until we get on the plane of sane business. There will be no need then for agonised enquiries into what is wrong with trade, and no demand for the nostrums so freely offered by various self appointed business practitioners. Let us all work for that day.

DIESEL ENGINE USERS' ASSOCIATION

At the last meeting of the Diesel Engine Users' Association, held at the Institution of Electrical Engineers, Mr. Oswald Wans, A.M. Inst. C.E., M.I. Mech. E., read a paper on "Some Recent Developments in Mechanical Injection Oil Engines Using Heavy Oils." The author dealt with some of the outstanding developments of two and four-cycle mechanical injection engines which had been instrumental in rendering these prime movers efficient and reliable. In connection with two-cycle engines reference was made to the light-load running gear adopted by Vickers-Petters, Limited, by means of which a portion of the fuel is injected well in advance of the main charge, thus giving the pilot charge time to vaporise before the entry of the main charge. Fuel consumptions as low as about .55 lb. per brake horse-power hour—equivalent to a brake thermal efficiency of 25 per cent.—were mentioned as having been obtained with a fuel of about .9 specific gravity and 18,300 B.Th.U. per pound. Discussing four-cycle engines, the author referred to the advantages which had accrued from the adoption of increased compression pressures, and gave particulars of the performance of a Ruston and Hornsby engine with a compression of about 425 lb. per square inch.

The general progress made with solid injection engines during the past five years had been marked, and there was good reason to believe that the limitations of the high-compression mechanical injection oil engine had not been reached. Already engines were built developing a maximum power of 200 brake horse-power per cylinder, with a brake thermal efficiency of 35 per cent. at working load, and one might confidently expect to see in the near future multi-cylinder engines developing 800 to 1000 brake horse-power.

The further development of the oil engine, whether of the mechanical or air injection type, was largely dependent upon the materials at the disposal of the designer, and the production of metals having greater heat-resisting properties demanded the close and continued co-operation of the engineer and the metallurgist.

REGULATIONS FOR WATER-TUBE BOILERS

The voluntary work done in Great Britain in connection with standardisation is known all over the world, and it has been supplemented by a considerable amount of enterprise in arranging rules and regulations in connection with the proper use of engineering equipment. One of the most recent examples is the set of rules prepared by a British committee governing the installation of water-tube boilers in merchant vessels. These rules have received official approval, and will therefore become standard practice. This committee intends to continue its labours in other directions where unified rules are likely to be of advantage.

THE WORLD'S FIRST MOTOR LINER

The first liner to be driven by oil was recently completed in Great Britain. She is a vessel of 8,000 tons and is equipped with two oil engines each with 8 cylinders designed to develop a total of 6,600 horse power. All the auxiliary machinery in the engine room and elsewhere is driven by electricity. As this vessel will be required to make regular non-stop runs for long distances, the propelling machinery has been subjected to very severe tests which it has passed with complete satisfaction.

Ottawa:—The Canadian naval squadron will be in West Indian waters for the winter season, and will visit all the ports between Bermuda and Demerara. The fleet consists of the cruiser "Aurora" and the destroyers "Patriot" and "Patricia." The two submarines sailed from Halifax last month under the escort of H. M. S. "Wistaria."

COASTWISE

The ships that trade foreign to London they bear
Their cargoes unnumbered both common and rare,
Their bales and their gunnysacks, tea-chests and cases,
From all kinds of countries and all sorts of places;
Their copra and teak wood, their rum and their bacca,
Their rice and their spice from Rangoon and Malacca,
Their sugar and sago from far Singapore.
And lumber and logwood and manganese ore.

But they that trade coastwise unceasing do ply
On lawful occasions to Ramsgate and Rye,
To Lowestoft and Lymington, Padstow and Poole,
And Falmouth and Fowey and Gorleston and Goole;
The North-country colliers, smutty and small,
The barges and bawleys and schooners and all,
The "Janes" and "Elizas" and "Belles" and the rest,
"Two Brothers," "Trafalgar" and "Pride of the West."

The ships that trade foreign wide oceans they know,
Far down to the South'ard they see the whales blow,
Great bergs like cathedrals they likewise behold,
And flying-fish shining all silver and gold;
They know the far islets of pearl and of pine,
The Trades and the tempests from Leeuwin to Line,
From the Horn to the Hooghly their smoke-trail is curled,
And their bow-wave is white on the seas of the world.

But they that trade coastwise they use the salt seas
That surge evermore round the grey mother's knees,
The tide-rips and swatchways, the deeps and the shoals,
Each eddy that dimples, each current that rolls,
By Longships and Lizard, by Bishop and Clerk,
And the fangs of the Manacles deadly and dark,
By reef and by sandbank, by headland and holm,
And Scilly's lone outposts of thunder and foam.

The ships that trade foreign see cities afar
Where the brown and the black and the yellow folk are,
The tin towns and timber towns, mud towns and all
From the Straits of Le Maire to the Bay of Bengal;
Of Rio and Sydney the charms they compare,
And others name 'Frisco than either more fair;
The lordly Saint Lawrence they mark in his flow
And Fraser and Hudson and mighty Hwang-ho.

But they that trade coastwise know little stone quays
With old salts a-smoking and taking their ease,
The smell of the seaweed, the nets in the sun,
The snug little tavern where old yarns are spun,
The coastguard, the flagstaff, the boats in the bight,
The herring gulls mewing by day and by night.
The flash of the lighthouse that flings forth his ray
To ships trading foreign that pass on their way.

C. F. S. in "Punch"

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The Year That Ends

THE year that is ending has been a hard one for the shipping and shipbuilding industries, as it has for practically every other line of endeavor. There will be many who will sigh with relief to see the end of it, and take a fresh grasp on hope and energy to start out with in 1922.

Canada may be said to be in the position of a man who feels himself very badly off, and inclined to a deal of self pity. On looking around he sees so many others in worse case than himself that his own state begins to appear a very enviable one. Canada, in comparison with other less favored corners of the world, has suffered comparatively little in the great year of readjustments and liquidations, and stands in a better position than most to avail herself of the opportunities that are coming.

As far as shipping and shipbuilding are concerned, there is no use in looking for any speedy picking up of business, but with the gradual development of the country, there will be a development in the interlake and coastwise shipping of the country, and this increase will be taken care of by the well established shipyards of the country. The proportion of building of Canadian vessels that is done in Canada will depend of course on the ability of the Canadian yards to compete with the British yards. As far as lake carriers are concerned we see no reason why Canadian builders should not get all this business.

We are glad to see in support of this contention, that a contract has been let within the last few days to one of the old-established lake shipbuilding yards for a bulk freighter for Canadian owners.

The trend of events in Great Britain, where costs of coal, steel, and labor are fast coming down to pre-war level, makes it very doubtful if Canada will have any chance of building ocean-going ships for foreign order in the near or distant future.

The lines now in existence in Canada, that is the intercoast and interlake lines carrying passengers and freight on well defined routes, are looking forward to better business and a natural expansion from year to year. Canada's Government owned merchant fleet will be retained most probably, and endeavor to create trade and cargoes for itself to carry, any deficits incurred being made up from the pockets of the general taxpayer.

It has been a bad year for Government-owned fleets of ships, and in the majority of cases the Governments affected have done their best to get rid of their possessions. The U. S. Shipping Board has taken a step in the right direction by wiping off their whole wooden fleet, thereby saving the enormous cost of owning them in idleness. Their steel ship problem has not yet been solved, and until the politicians cease tinkering with the maritime laws in order to catch votes, there will be no possibility of solving it.

France has sold her state-owned fleet to the merchant shipowners of the country, giving them liberal terms to effect the purchase, and adopting certain safeguards to protect the Government. Italy is using a system of subsidies to bring her merchant fleet up to the tonnage which she feels is necessary. All vestige of Government control in Great Britain has been wiped off, and the shipowner is at liberty to work out his own salvation which he is eminently capable of doing, free of the restraining and incompetent hand of the Government.

Germany is beginning to find her way back into the company of the maritime nations, and although this return is accompanied in some instances by swashbuckling speeches from German notables, it is heralded as a good omen by most of the world.

The indications for improvement in trade in the coming year are world wide. There is the great factor of cheaper coal in Great Britain, which has such an enormous effect on Great Britain herself and also on the trading possibilities of a large part of Europe. There is a tendency for the nations to get further away from the feeling engendered during the war, and recognize that to live they must trade and trade together. The conference in Washington on the reduction of armaments will undoubtedly result in some benefits, although up to date the only country that has done anything except talk, is, as usual, Great Britain. It is to be hoped and expected that Lloyd George and Briand will find some method of adjusting the German reparations in a way that will be least harmful to both nations, and most beneficial to the general condition of world trade.

Russia seems to be gradually learning that the introduction of Utopia cannot be brought about by the simple expedient of murdering everyone who does not agree in its view of what constitutes Utopia. Russia is showing signs of actually preparing to go back to work, and perhaps there is no single factor in world affairs that would have such a good effect as the return of Russia to the ranks of the producers.

Coming back to Canada, we are pleased to note that our Canadian dollar is fast approaching equality with the American dollar, in spite of Fordney bills, etc. A new Government is about to take office, and if it will go along quietyl, without attempting to interfere drastically with the country's business, until things have progressed a little nearer normal, we shall probably see our dollar at par before very long. There will be variations in value, no doubt, but the tendency should be upwards. Canada is fundamentally sound, and is a treasure house that only needs systematic development to bring forth its riches. To carry out this development needs capital and population, and there is no reason to think that Canada cannot attract both these necessaries. Canadian credit has suffered somewhat of late for various reasons, but not to any great extent.

Looking over the whole situation, Marine Engineering feels that it is with every possibility of the wish being fulfilled that it sends to its readers the message of a "Happy and Prosperous New Year."

News of the Shipping World

THE LATE Glen liner "Glenapp" has now been completed, after considerable alterations, for her new owners, the Elder Dempster Line. From being a motor cargo vessel, she has been converted to the first motor passenger liner not only of the Elder Dempster fleet, but of any other. She has accommodation for 225 first and 140 second and third class passengers, and the saloons, cabins and staterooms are comfortable in the extreme. The West African trade is one of those where the same passengers, to a large extent, are carried a good many times in the course of a few years, and the average West coaster is an individual who appreciates all the comfort he can get. The exigencies of the climate force the residents to make frequent trips home for rest and recuperation, and they develop very strong likes and dislikes for particular ships and the personnel of those ships. The converted vessel has been christened the "Aba," a name well known in the West African line, and she is expected to achieve a considerable amount of popularity among travelers between England and the coast. There is also an extensive trade at certain times of the year between Liverpool and Las Palmas, and Madeira, which are calling ports for the West African liners on their way out and home, and the people using the Elder Dempster line for this trip look for a high standard of comfort. This, it has been the aim of the new owners to furnish.

* * * *

IT IS UNDERSTOOD that the United States Shipping Board, through their representative, Mr. Love, and Sir Ernest Raeburn, acting for the British lines, have reached an agreement in the controversy over the carriage of Egyptian cotton. The agreement has not yet been ratified at the time of writing this, but there is every probability that the principals will ratify the agreement reached by the negotiators. Sir Frederick Lewis, speaking at the annual meeting of the Prince Line, alluded to the competition of the U. S. Shipping Board fleet, and recognized it as a competitor, but was not disposed to either belittle or magnify its possibilities. He saw no reason, with goodwill and breadth of vision on both sides, why the competition could not be carried on with fairness to both.

* * * *

THE VIEW of the shipping situation held by certain people in Germany is well illustrated by the following extract from a German newspaper, reprinted in "Syren and Shipping," London. It shows that the feelings of at least some of the German people are not those of resignation or repentance. The passage quoted is as follows:

"The industrial expansion of Germany constituted in the eyes of our chief and most envious rival, namely England, a just cause for making war upon us, our enemy's object being to render German industry, and especially German ocean shipping, incapable of further competition. It was this envy that was the whole motive and driving force of the war. This is a fact which is emphasized in every line of the disgraceful peace treaty of Versailles and of the London ultimatum. But, badly hit though German shipping has been through the war that was forced upon us, it has not been destroyed, nor has German shipbuilding either. Already the ships of which we have been robbed are being bought back by German shipowners; new ships are on the stocks in German yards; they are rapidly being launched and plough the waves under the black, red and white flag. In England consternation reigns at this, but they are facts which England will have to face as best she may and the conditions which we are creating she will have to tolerate and adapt herself to, unless the execution of the London ultimatum should really attain its end, the industrial annihilation of Germany. In that case, however, not we, but the whole world will have lost the war."

The "Syren and Shipping" merely offers to this the comment that the "consternation" which reigns in Britain will not interfere with British commerce and shipping. The Germans may build what they choose; we shall build what we need.

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AS AMONG men so among ships, there are some that never seem to fit into the occupations in which they find themselves engaged. A curious case is reported in the shipping press of the steamer "Macedonia." This vessel has just been sold to French owners by the Holland General Atlantic Steam Navigation, a Rotterdam company. Her history is a peculiar one. Shortly after being built, she was sold to Greek owners to act as an emigrant ship, but the first Balkan war coming along soon after, she was sunk by gun fire, and her career as an emigrant ship cut short. She was raised in 1917, and taken to Rotterdam, where she was repaired and altered to make her into a pure cargo carrier. After this was done she was bought by a Dutch company for 3,000,000 florins. Instead of going into service, however, she remained laid up in Rotterdam for about two years until after the Armistice. At this time she was pressed into service to convey French refugees from Rotterdam to Havre, and this necessitated her again being converted into a passenger ship. After finishing this little job, she was converted back into a cargo carrier, and this was hardly completed, when she was again converted this time into a floating exhibition ship. These various conversions were represented by a mortgage of more than a million florins, but in spite of all these vicissitudes she is again to undergo a further conversion to make her suitable to her new owners.

* * * *

THE QUESTION of the eight hour day at sea was brought up in the British House of Commons recently when Dr. McNamara asked the House to approve the action of the Government respecting the Draft Conventions and Recommendations adopted by the International Labor Conference held at Genoa last year. It will be remembered that one of these resolutions or recommendations had to do with the adoption of an eight hour day for those employed on ships at sea, and that the British delegates accepted this as a standard to be aimed at, but were not able to agree to its immediate application. Before any such recommendation could become of any effect, it would of course have to be put in the form of legislation, which would take the form of an amendment to the Merchant Shipping Act. We fail to see how any such thing as an eight hour day at sea could ever become a practical possibility, and furthermore what good it would do any one that came under its effects, except in the way of increasing their pay by means of overtime. In ships of ordinary ocean-going type there is for a large part of the crew, what practically amounts to an eight hour day, that is two watches of four hours, with intervals of eight hours between them. In the case of the firemen, where there is no ash ejector installed, it is necessary for the firemen to work a certain period of their watch below in handling the ashes, while the engineers, who are also supposed to work on the four on and eight off principle, usually find a job that requires doing in the time supposed to be off. Sailors usually work on a four on and four off basis, except a certain percentage known as idlers, who are on day work. They work usually about nine hours a day, which is no hardship. A man aboard a ship with too much leisure time on his hands is in a bad way and usually doesn't know what to do with the idle hours. He is liable to develop into a sea lawyer. From our own knowledge derived from a number of years spent at sea, we cannot see where any body is going to be benefited by such an arrangement, where-

as on the other hand we can see where a lot of harm could be done to the shipping industry.

COMMENCING Dec. 3rd the Furness Withy Co. have inaugurated a service from London, Leith and Swansea to Northern Pacific United States and Canadian ports. The first sailing is that of the "Mongolian Prince," and her cargo will consist of tinplate, the first installment of 150,000 boxes comprising 25,000 tons. This order has been secured in competition with American firms by the Welsh tinplate makers. The return cargo will doubtless consist of the tinned goods which the tinplate furnishes containers for. The next sailing is advertised from London on Dec. 23rd by the "Eastern Prince."

The trend of ship prices may be gathered from an auction sale held recently at the Baltic Mercantile Exchange in London by Messrs. O. W. Kellock & Co., at which three steamers "Madame Beatley," "Madame Lundi" and "Madame Midas" were sold. The "Madame Beatley," a steamer of 1131 tons, built at Port Glasgow in 1907, with a deadweight capacity of 1720 tons was sold to British buyers for £10,275, or about £6 per ton. The "Madame Lundi" with a deadweight of 330 tons, built in 1917, was sold to British buyers for £114 per ton while the "Madame Midas," built at Port Glasgow in 1904, carrying a deadweight of 3624 tons, was sold to Greek buyers for £11,350, or a little over £3 per ton.

POST WAR developments in the French merchant marine fleet have been against the retention of the fleet as a Government-owned entity. The fleet has been sold, but under an arrangement which is beneficial to the Government and the purchasers. The French mercantile marine are the purchasers, by which is meant the whole of the companies carrying on ship-owning, and these are represented by a committee. The terms of purchase allow of a long period over which payment can be spread, and in the interval the Government retains ownership. While they still have title to the ships, all maintenance costs, etc., are borne by the purchasers. The value of the ships was fixed by a firm of British experts, and was deemed satisfactory to both parties. There is an arrangement by which, if the price of ships rises at the end of five years, the Government will get the benefit of the difference between the present selling price and the latter one.

* * * *

LLOYD'S Annual Report for the year 1920-1921 has now been issued, and as usual contains a number of interesting facts. Attention is called to the number of vessels fitted to burn oil fuel, the tonnage represented having increased from 1,310,209 in July 1914 to 12,796,635 in July 1921. The consumption of coal that would be necessary for these vessels if they were still coal burning, would represent 20,000,000 tons per annum or 8.7 per cent. of the quantity of coal brought to the surface in the United Kingdom in 1920. The report also gives some chronological facts bearing on the use of oil fuel. Thus the first vessel fitted with an apparatus for burning heavy oil derived from shale was the "Himalaya" and an experimental voyage was made from London to Granton and back, the oil being carried in barrels on deck. The next instance recorded was that of the "Ani," and also of the "Sevan," which in 1886 were fitted to burn oil, the fuel being carried in the bunkers. Again in 1887 the "Charles Howard" was fitted with oil carried in bunkers, the result in this case also being a failure. It was not until 1892 that a vessel was successfully adapted to burning oil fuel regularly at sea, and in this year the "Baknin" was so fitted, and continued in regular service with oil fuel. Dealing with the adoption of internal combustion engines the following interesting figures are given: In July, 1914, the number of vessels classed as motor vessels was 297 of 234,287 gross tons, while in July, 1921, the number had increased to 1473, with a gross tonnage of 1,348,800. Of these vessels 287 are of 100 gross tons and over, while of those of less than 1000 gross tons, more than half depend entirely on their motors for motive power. It is noteworthy that with the exception of three steamers, all those built in the United States during the year covered were fitted for oil fuel burning.

SIMPLE REVERSING DEVICE FOR SMALL MOTOR BOAT

A new and fool-proof reversing device has been developed for small motor boats that employs neither gears nor variable pitch propellers.

The astern movement is obtained by deflecting towards the bow, by a specially designed flume, the backward moving water from the propeller.

The 16 foot boat in the photo has been in operation in Muskoka, Ontario, for the past year and has given economical and satisfactory service.

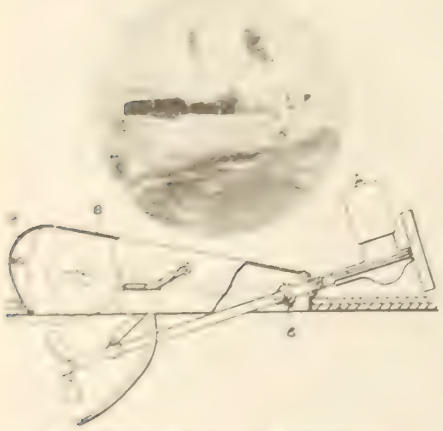

Diagram of Reversing Arrangement

Besides driving a boat astern at a useful speed, this device has none of the faults common to the usual method. The reversing force is applied directly against the line of movement, thus eliminating "crabbing" or side movement when in reverse.

In the sketch No. 5 is a universal joint allowing propeller to be raised by the handle or by the skeg should any obstruction be encountered. No. 10 is the deflecting faces that gather and reverse the direction of the propeller stream, leading it forward in the flume No. 8.

In the experimental boat a speed of seven miles an hour was obtained forward, and three astern, with a two horse power motor.

The device is patented by Andrew D. MacLean, 340 Adelaide Street, West, Toronto, Canada, U.S. No. 1,385,488 Canadian No. 214,047.

To speed up its trans-Pacific freight service the "Nippon Yusen Kaisha,," is replacing the "Tokushima Maru," "Genoa Maru," "Delagoa Maru" in the north Pacific trade with the "Toyama Maru," "Hakata Maru" and "Tokiwa Maru." The passenger liners "Fushimi Maru," "Katori Maru" and "Kashima Maru" will continue in the service.

MATHEWS STEAMSHIP COMPANY'S NEW STEAMER

A. E. Mathews, president of the Mathews Steamship Company, closed a contract today with Mr. James Whalen, president of the Port Arthur Shipbuilding Company, to build a large steel bulk freight steamer, for service on the Great Lakes.

She will be, according to design, the most modern lake freighter ever constructed, on either the Canadian or the American side, having a carrying capacity of over 400,000 bushels of grain. Her dimensions are:—

550 ft. over all,
58 ft. beam,
31 ft. deep

and of all steel construction, with a power plant composed of one triple expansion engine, size 25½in.-41in.-67in. x42in. stroke, furnished steam by three Scotch boilers, size 13ft. 6in. dis. x 11ft. 2in. long, each boiler containing three interchangeable Morrision furnaces, working under pressure of 185 lbs. steam.

It is to be constructed under the personal supervision of Mr. J. H. Smith and is to be classed by the American Bureau of Shipping with a Class of A. 100 for this service.

The Lubrication of Prime Movers

The Question of Lubrication in These Days of High Speeds and High Temperatures Is Somewhat More Difficult Than Formerly—Some of the Factors Leading to Success Are Given in the Following Article

By C H. BROMLEY

OF ALL prime movers the steam turbine presents the severest condition for the lubricant. The journal speeds are higher than in any other class of machinery; the bearing pressures are relatively low, yet they are great, and becoming greater; the temperature, particularly of the bearing adjacent the high-pressure end, also the thrust bearing, is extremely high, even normally. Total steam temperatures at the throttle of between 600 degrees and 700 degrees F. are becoming common. Heat at this temperature is conducted to these bearings in addition to the heat of friction generated in the bearing itself. The oil circulates to the bearings rapidly—from 7 to 40 times per hour.

With these conditions to be met, the lubricating system must function so that at no time, not for a fraction of a second, shall there be metallic contact or metallic friction between the journal and the bearing shell. I know of no case where metallic friction has occurred that severe damage to the turbine did not result. The oil-pressure varies from 2 to 15 lb.; usual oil temperatures are between 130 degrees F. and 180 degrees F. Thrust-bearing temperature is usually 2 degrees F. higher than that of other bearings, except the high-pressure end bearing.

Oils for Steam Turbines

Our experience, as well as that of others, shows that for steam turbines nothing but a straight-run mineral oil will do. It must not be compounded or blended with any product, not derived from crude petroleum. There should be no animal or vegetable fats in it. Water will get into the lubricating oil in a steam turbine, however careful the design and machinery of the unit, and however cautious the operator. And oil containing animal fats will emulsify and form sludge so badly as to be dangerous. The Prime Movers Committee of the N.E.L.A. in its 1921 report, page 6, well states it as follows: "Compounded oils are not to be considered, as turbine oils should be strictly pure, neutral mineral oils, without any admixture of animal or vegetable fats." The flash-point, open cup, should not be lower than 315 degrees F. for extra-light oil, to 335 degrees F. for medium. High flash-point is desirable, as it indicates slow evaporation and ability to retain original viscosity, provided also that the oil is slow to oxidise.

There is still much to learn about viscosity for turbine oils. However, the safe guide limits now are 110 secs. to 350 secs. Saybolt at 100 degrees F. The higher the speed the lower the viscosity may be. I have heard of excellent results with oil of 80 secs. viscosity. While this may be "sliding on pretty thin oil," to paraphrase an old expression, it is probable that we will eventually discover that there is no need for as much apprehension about thin oil for turbines as is now general. What chiefly concerns us is the viscosity at normal operating temperatures, and the ability of the oil to retain its viscosity throughout a long period of service.

Emulsion and Sludge

Emulsion and sludge form one of the chief worries of the turbine operator. If allowed to accumulate, they make impossible safe operation of the turbine.

An emulsion is a mixture of liquids, insoluble in one another, where one is suspended in the form of minute globules; also it is a mixture in which air and solid particles, or both, are suspended in a liquid. The turbine oiling system is practically ideal for promoting the formation of emulsion. Water and moisture will get into the oil from leaky shaft glands, leaky oil-cooler coils, and bearing cooling coils where water-cooled, also from the atmosphere. The churning to which the oil and water are subjected in the circulating system forms an emulsion wherein the particles are very finely divided. Obviously the pressure oil film in the bearings will be seriously impaired by such an emulsion, and the risk of serious damage to the turbine will be imminent.

Sludge is that nasty, brown-blackish substance one finds in the turbine-oil reservoir, oil cooler and oil piping. It is the result of oxidation of the oil. If emulsion is allowed to accumulate, it soon results in sludge. The unsaturated compounds in the oil are more rapidly oxidised, and the metallic particles, dirt, dust, etc., apparently act as catalytic agents, for the formation of sludge increases at an accelerating rate with the formation of organic acids.

Standard of Demulsibility

It is up to turbine operators to demand the adoption by engineering societies of some workable standard of demulsibility for turbine lubricating oils. The term "good" demulsibility means nothing to an engineer, yet that is about all the information generally available.

Here is a way to make the Bureau of Standards test for demulsibility that is practicable: Apparatus necessary—a malted-milk mixer such as used at soda fountains, a thermometer, a 100 c.c. graduated vial, and an electric hot-point or other means of heating the sample. Mix 40 c.c. of water at 55 degrees C. (132 degrees F.) with 20 c.c. of oil. Keep the mixture at 55 degrees C. and emulsify in the mixer for five minutes. The number of cubic centimetres of water that settles out in one minute multiplied by 60 (the number of minutes in one hour) equals the standard demulsibility number for the oil. The perfect number is 1200, being 20, the total water volume, multiplied by 60, the total number of minutes in one hour.

Where the oil is continuously kept clean, as in the continuous bypass system, the acid content seldom, if ever, gets over 1 per cent, even after years of service of the oil. In fact, analyses have shown less acidity after two years' continuous use of oil purified by the continuous bypass system than the oil contained originally. The explanation probably is that the acid is entrapped in impurities in the oil, and the continuous removal of these keeps down the acid content.

Methods of Maintaining the Quality of Turbine Oil in Service

We may disregard sweetening and merely add make-up oil, because in modern practice, particularly with turbines of from 700 kw. capacity upward, no one would think of trying to keep the oil in good condition by such means. To attempt to do so is to fail, because one merely dilutes the impurities; they are not removed.

Batch filtration was universally practised until a few years ago, or until the advent of the continuous bypass system. Batch filtration was a decided improvement over sweetening, but it has several objectionable features. The entire oil charge is drained at intervals—when, rests entirely upon the operator's judgment and upon circumstances which may delay the cleansing of the oil until long after it should have been done. The quantity of oil in reserve must be large. The really serious objection is that batch filtration does not prevent the accumulation of emulsion and sludge.

When considering turbine-oil purification, the average engineer thinks of oil loaded with emulsion, filth and sludge. He must see it differently, for with modern means available the oils never get unfit, provided the right oil has been selected, the oil reservoir and piping are clean to start with, and water and steam leakage from shaft glands, cooler, and other sources are kept down, as they can and should be.

This system of purification, adopted as standard by one large builder of turbines and highly endorsed by all other turbine builders and leading oil companies, consists of a sight over-flow, a filter, an oil pump, and the necessary piping. The vented sight overflow is connected directly to the turbine-oil reservoir, so that its overflow level corresponds with the desired oil level in the reservoir. The outflow of oil from the reservoir is automatically controlled by and is equivalent to the amount of oil delivered by the filter pump from the filter to the reservoir. Should this pump stop for any reason, the turbine continues to operate as though no system were installed, as this system is entirely independent of the self-contained oiling system of the turbine furnished by its builder. It is plain that a

*A paper read before the System Operators' Association.

certain percentage of the total oil charge is passed through the filter per hour, and that purification of the whole charge is continuous. Emulsion and sludge cannot accumulate, as they are removed as fast as formed. At first one is likely to say that with this system clean oil from the filter is put into the dirty oil in the reservoir. The answer is that with this system there is no dirty oil either in the turbine reservoir or the filter.

Diesel-Engine Lubrication

Diesel-engine cylinders cannot be successfully lubricated by methods satisfactory for steam or air engines. Unless application of the lubricating oil is timed for a particular part of a particular stroke, there is every likelihood that, without extravagant use of oil, the lubrication will be burned away before it has time to function as a lubricant.

In the practice of one of the leading Diesel-engine builders the oil is delivered to the piston through the cylinder wall at two places 180 degrees apart. For the piston pins the oil is fed through the cylinder wall into a slot in the piston which comes even with the oil hole when the piston is on its lower centre.

The lubricator uses alternate forcing plungers on opposite sides of the gear or plunger-actuating shaft; thus any two adjacent plungers force oil when 180 degrees apart. By arranging the feeds in groups, each group on a separate gear-shaft, and the shafts driven through gears or eccentrics or chains from the engine, any desired timing of delivery may be had. Ordinarily, the lubricator has a layshaft and three eccentrics set 120 degrees apart; the lubricator gear-shaft is so divided that eighteen feeds are driven in sets of six to each eccentric and of these six feeds three plungers are on one side of the gear-shaft and three on the other. The lubricator has a divided oil tank to permit of using a different oil for the air compressor of the engine.

The oil is delivered among the piston rings on the lower centre at the end of the power stroke. This ensures thorough coating of the cylinder wall before the power stroke, during which the cylinder temperature is greatly increased owing to combustion.

Usually the crankpins and main bearings are lubricated by a gravity system which supplies the oil through gang sight-feed oilers, located on the engine frame columns.

A leading builder uses two feeds for each main bearing, and one feed for the centrifugal oiler for each crankpin. All oil fed to these bearings and to the piston pins is caught in the engine base. One end of a small double pump delivers the oil to a filter conveniently located, the other end taking it from the clean-oil compartment of the filter and delivering it to a tank at such elevation as to give the desired pressure at the sight-feed gang oilers feeding the bearings.

Camshaft rollers are grease lubricated by hand-operated cups and valve tappets and rockers by oil from a squirt can. These could be automatically lubricated like the rest of the unit, but is purposely not done so, to ensure attention and watchfulness on the part of the operator.

In marine practice practically the entire engine is force-feed lubricated at low pressure. A tank in the ship's double bottom holds the oil supply. A circulating pump discharges into a cooler and then into a main parallel with the engine bed; branches from the main supply each main bearing and the thrust bearing. Holes in the crankshaft register with circumferential grooves in the main-bearing shells and feed oil to crankpins and piston pins.

Practice in Marine Diesel Engines

The usual precautions are, of course, necessary to prevent leakage of salt water into the oil reservoir or sump, and into the oil supply from the cooler. Here pistons are oil-cooled and the crankpins and piston pins are supplied with oil through holes in the crankshaft and connecting rods, trouble is likely to arise owing to carbonised oil flaking off and clogging the oil passages.

These engines are, of course, tightly enclosed and bearings cannot be felt for temperature A thermometer in the oil-return pipe will indicate a serious temperature rise, but will not indicate the bearing affected. Various jimcracks to indicate such have not been very successful. Care is therefore necessary to adjusting bearing clearances and keeping the oil, oil tank, and passages clean.

Reclamation of Internal-combustion Engine Lubricating Oil

Naturally, because of the high temperature, considerable carbon is formed. When the oil is too heavily loaded with it, the carbon must be removed. This carbon is extremely fine. Filtration alone or centrifugal separator alone does not remove it all satisfactorily. The best results are obtained by the use of the reclaimer.

This reclaimer is in the form of a cylindrical shell. The dirty oil is heated by steam at 212 degrees or higher to bring about a satisfactory difference in the specific gravity of oil and foreign particles and water. After the heating period a coagulant is mixed with the oil and the mixture allowed to settle. Usually a batch of oil is reclaimed every twenty hours. After sett'ing is completed it is best to allow the oil to run through a filter, which is readily attached to the reclaimer. These reclaimers are built with electric-heating elements where steam is not conveniently available.

ECONOMY IN THE BOILER-HOUSE

Below we reproduce a diagram for the guidance of boiler-house staffs, issued by the Fuel Economy Committee of the Federation of British Industries, 39 St. James's-street, London, S.W.I. The diagram can be obtained printed on metal plates 20 in. by 30 in. for hanging in the boiler-house.

1. Avoid wastage of cinders in the ashes by cleaning the fires carefully and by using suitable firebars.

2. Avoid production of black smoke and incompletely burnt gases by regularly and frequently firing coal in small quantities. Keep a proper depth of fire.

3. Regulate the draught by the damper to reduce the excess air. Try to obtain 12 per cent CO_2 in the chimney gases.

4. Keep the grate properly covered with a level fire. Use the rake when necessary for this purpose.

5. Examine the boiler setting carefully for air leakage, particularly furnace doors, cracks in the side walls, joints between the boiler shell and brickwork, and the damper slides.

6. Keep the boiler surfaces free from soot and flue dust.

7. Keep the internal boiler surfaces free from scale.

8. Do not force the boilers unnecessarily.

9. Examine the seating blocks and partition walls carefully. Repair if necessary to avoid by-passing.

10. Lag the exposed surfaces of boilers and steampipes efficiently.

11. Avoid excessive blow-down.

12. Keep the boiler filled to the working level by a continuous and steady feed.

13. Avoid leakages of steam from boiler fittings and valves.

Word has been received from Montreal that the International Paper Co. is planning to start its newsprint mill at Three Rivers, Quebec, during the month of February. It is understood that the initial production will be 100 tons a day from two machines with a capacity of 50 tons each. It is planned to increase this amount shortly, if the market warrants, by another 100 tons a day, making the total production 200 tons a day, or 60,000 tons per year.

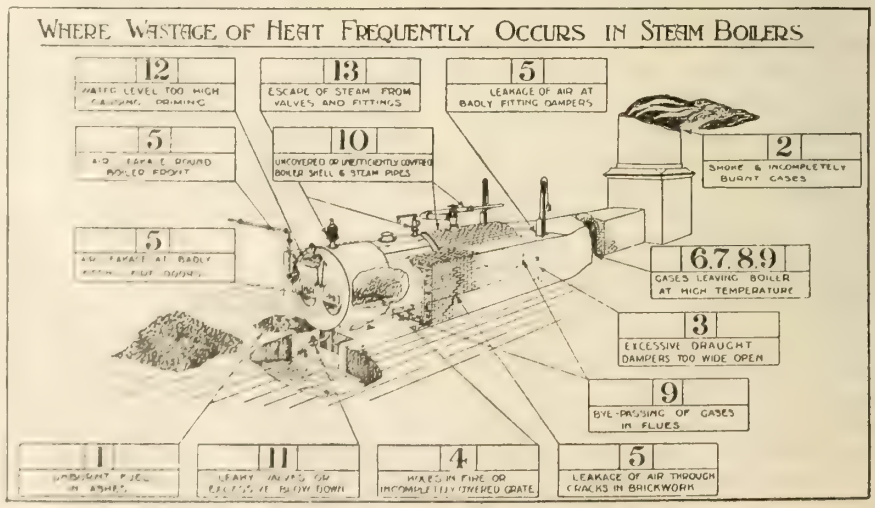

Diagram showing boiler losses.

Marine News From Every Source

Montreal:—Although winter has set its seal upon the local harbor and has largely emptied its wharfs of shipping, the Port of Montreal had its last steamer arrival on the night of December 13th when the freighter "Geo. W. Clyde," found from Philiadelphia to Chicago with a cargo of sugar, arrived here on her way to the Great Lakes. This is the latest date on which any vessel has reached Montreal from the sea for the past thirteen years, the last instance of late arrival being that on December 13th, 1908 of the steamer "Dunelm" which was compelled to spend the ensuing winter in port here. A further record is created for the Port of Montreal by the arrival of the "Geo. W. Clyde" inasmuch as the local harbor has had a longer season of navigation in 1921 than in any year of its history according to all available records. When the first steamer of the season docked here on March 29th last it constituted the earliest opening of the port for seventy years and the passage up stream of the "Geo. W. Clyde" on December 13th makes the duration of the 1921 season of navigation eight and one half months. In 1920 the season opened with the arrival of the first ship on April 18th and closed with the departure of the last steamer on December 2nd. Unusual arrangements were made to facilitate the passage of the "Clyde." She was convoyed to a point well above Lake St. Peter, by the Government steamer "Lady Grey" and experienced little difficulty on the remainder of the route to Montreal notwithstanding that the gas-buoys which usually illuminate this channel by night were taken up by the Marine Department some little time ago, leaving only the unlighted winter buoys to mark the passage. On her arrival in Montreal on the evening of the 13th shortly after eight o'clock she proceeded at once to the entrance of the Lachine Canal, the authorities having taken special precautions to keep the canal open for her passage. The "Clyde" is owned by the Chicago Steamship Co. and has a net tonnage of 1,514. She is 264 feet long, only one foot less than the length of the Lachine Canal locks and at first it was doubtful whether she would be able to pass through or not, the locks being full of loose ice packed several inches thick. To break this up the Harbor Commissioner's tug "Sir Hugh Allan" was sent into the canal before the American vessel with instructions to precede her until she was completely through the canal. The American steamer entered lock No. 1 about nine o'clock, and it was nearly an hour later before the canal officials could close the gates and pass her through into the next lock. However, she continued making progress all through the night and on the morning of the 14th she was able to enter Lake St. Louis. The Lachine Canal was being kept open especially to permit the passage, and as soon as the "Sir Hugh Allan" returned to the harbor navigation on the Lachine Canal for the season of 1921 will have been completed.

* * *

Montreal:—Captain Ebenezer Cook, R. N. R. of the Canadian Pacific Liner "Empress of France," died at Liverpool on Wednesday Nov. 23rd. His ship had docked in Liverpool only on the 22nd just twenty-four hours before. The captain had not been in good health for some time but his death came as a distinct shock to all who were intimately acquainted with him.

Captain Cook was 52 years of age, and was well known in Montreal and on the St. Lawrence route. For thirty years he had been in charge of ships trading into the St. Lawrence ports. He was commodore of the Canadian Pacific fleet, and was one of the oldest officers in the company's service. Captain Cook held the record of having carried four Governor-Generals between England and Canada, the Earl of Minto when commanding the "Tunisian"; Earl Grey while on the "Virginian"; and the Duke of Devonshire and Lord Byng on the "Empress of France."

Captain Cook came from a family of seafaring men. He had been at sea thirty-seven years and had spent his early days on sailing vessels. The first ship on which he sailed as an apprentice at the age of 15 years was a little vessel of 262 tons. The command that he held at his death registered 18,500 tons. Captain Cook was on the bridge of the "Empress of France" when she was doing convoy work during the war, under the name of the Alsatian. Sir Eric Geddes paid particular tribute to the work done by the Alsatian at this time. From 1914 to 1917 this tenth squadron, of which the Alsatian was flagship, kept under its guard a stretch of sea 800 miles long, from the Orkneys to Iceland, and during this time intercepted 1,500 enemy ships taking supplies to enemy countries. Athough this work was accomplished mostly at the dead of night, or in bad light and blizzards, less than four per cent of the vessels succeeded in passing the lines of the blockade.

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Montreal:—A new record and one that may not be equalled again in a long while is that of the Hudson's Bay Company ship "Nascopie." The steamer was reported safe in the harbor at St. John's, Newfoundland, about the twentieth of November. When reported she was about ten days overdue and some anxiety was felt for her safety.

Both trips of the ship were made with cargoes, the second one consisting of a load of Norwegian reindeer over seven hundred in number, and also full supplies for the station at which the deer were landed, far up in Baffin Land.

Captain Mack, a Montrealer, and superintendent of the Hudson's Bay Company Marine Department, was on the ship as well as her navigator, Captain Mead, so there was of the best of Arctic navigators to extricate the ship in her hurry south from an early winter. Her first trip to the North from Montreal was her usual one with supplies to the trading posts leaving in July. She then sailed from the North to Cardiff and there unloaded furs, proceeding thence to the North of Norway where the first cargo of reindeer on record was loaded. The "Nascopie" encountered wintry conditions soon after sailing from Norway, which conditions were well suited to reindeer.

The "Nascopie" underwent some minor repairs at St. John's as she sustained nominal damage when nipped, bucking her way through heavy fields of newly formed ice.

* * * *

Montreal:—The Canadian Pacific Steamships, Limited, announced a few days ago that Capt. Jas. Gillies will be the new commander of the "Empress of France," succeeding Capt. Ebenezer Cook whose death occurred at Liverpool a short time ago. Capt. Gillies has had a distinguished record with the Allan Line and the Canadian Pacific Steamships, Ltd. He is well known in Montreal, to which port he has operated for many years. The ships on which he has served and commanded include the "Mount Royal," "Monmouth," "Mount Temple," "Montezuma," "Keewatin," "Lake Michigan," "Ruthenia," "Lake Manitoba," "Milwaukee," "Eunice,"

"Grampian," "Missanable," "Metagama," "Metheen," "Melita," "Victorian" and the "Prinz Freidrich Wilhelm."

* * * *

Montreal:—The contract for an ice breaker, awarded to Canadian Vickers, Ltd., by the Dominion Government will provide employment for a good number of men during the winter. This vessel will really take the place of the one that was built some years ago, and turned over to the Russian Government on the outbreak of the war. Mr. Ballantyne, Minister of Marine, in speaking of the awarding of the contract, said that by delaying the date of its award he had made a saving in the cost of $750,000.

* * * *

Quebec:—The steam Schooner "A. Trembley," which plies ordinarily between Montreal and Quebec to Gaspe as a freight carrier, calling at intermediate ports down the St. Lawrence, had a rather unpleasant experience off Matane during the snow storm on Thursday night, November 24th, and had to seek shelter at Rimouski, with her hold full of water. The "Trembley" left Quebec on Sunday afternoon, November 20th, with a full cargo of miscellaneous goods, including building materials and provisions for Gaspe. There was also a heavy deck cargo. According to reports the vessel encountered a severe snowstorm on Thursday night and the sea was so heavy that the combers swept over her, and at times had her practically under water. The cold water as it struck the deck formed ice—coating the vessel from stem to stern. Captain Trembley, master and owner of the vessel, had his crew jettison a large part of the deck cargo but managed to navigate the ship safely to Rimouski where she tied up, and it was found that the water had gotten into the holds and engine room sufficiently to cripple the boat and prevent her sailing.

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Montreal:— The last Transatlantic Steamer of the season to come to Montreal was the Head Line freighter Lord Ancras. This steamer arrived in Montreal on Saturday, December 3rd, and cleared on Tuesday, December 6th, for Scotland and Belfast.

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Toronto:—An old favorite around the water front, Archibald McKay, one of the crew of the tug Geary, died at his residence in this city on Dec. 9th. Mr. McKay who was born in Scotland, was for over twenty years a member of the lightship Pharaoh crew in the Firth of Forth. He came to Canada about 15 years ago. Deceased was 61 years old and leaves a widow, a son and daughter.

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Fort William:—One of the old hands among the grain trimmers met with a sudden death while loading the steamer W. D. Mathews. The man in question, Fred Payette, fell down the hold and was instantly killed, through stepping on a loose hatch cover.

Fort William:—A general clearance of steamers from this port was made about the middle of the month, when about thirteen steamers were loaded and despatched for the lower lakes. They took between them about 4,000,000 bushels of grain. Only one steamer will winter in Fort William with a storage cargo this season.

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Port Arthur, Ont.:—Six of the Canadian Government Merchant Marine fleet came up to the head of the Lakes early in December. They were the "Canadian Engineer," "Canadian Adventurer," "Canadian Sower," "Canadian Sailor," "Canadian Trader" and "Canadian Pathfinder." The "Engineer" loaded grain for Toronto, while the other vessels loaded for Georgian Bay ports.

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Port Arthur:—The yards of the Port Arthur Shipbuilding Co., will be kept fairly busy during the winter. The steamer "Huronton" will be repaired, and the company will build twenty low pressure heating boilers for the western trade. They are also in hopes of obtaining a contract for a bulk freighter for lake service.

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Kingston:—It is reported from Kingston, Ontario, that Capt. Joseph Dix is dead at the age of eighty. He owned at different times several sailing and steam vessels, including the "Greyhound," "Olive Branch," "White Oak," W. J. Suffle" and "Galeria." He had retired some few years ago.

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Kingston:—It is reported that early in the Spring of 1922 the Canadian Government will commence work on the erection of a modern life-saving station on the main Duck Islands in Lake Ontario. This station, as at present contemplated, will be one of the most modern in Canada and a full wireless installation will be part of the equipment. This will be very welcome news to mariners who have occasion to navigate the Eastern portion of Lake Ontario, as the number of wrecks in this vicinity have always been much greater than those of any other part of the lake.

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Kingston:—This city seems to be in favor as a winter port for Lake steamers, there being more steamers here this year than last. Altogether there are about twenty vessels tied up.

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Saulte Ste. Marie:—The wrecking outfits had but little time for reflection in the early part of the month. Typical of their activity may be mentioned the case of the wrecking tug Favorite, which after unloading 1,500 tons of the cargo of the Philip Minch into lighters, floated the vessel. She had so sooner arrived in port with the Minch than she was sent post haste to the steamer "Hydrus" which was ashore.

Sault Ste. Marie:—The traffic through the St. Mary's River canals during the month of November showed a great falling off from that of the corresponding period of 1920. The actual tonnage was only about a third of that of the previous year, the figures being for November 1920, 9,419, 580, while for the month of November, 1921, they were 3,265,470.

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Brockville:—The death is reported from Brockville of Captain Julian Malette aged 60. Deceased was a well-known figure in St. Lawrence Navigation, and for the last 25 years had been in the employ of the late Senator Fulford and later of Mrs. Fulford as master of the steam yacht "Magedoma."

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Port Huron:—The wreck of the tug "Pauline Hickler," which sank two miles north of the Corsica Shoal Lightship, has been lifted and removed to deep water. The scow "Detour" was employed to remove this menace to navigation.

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London:—The first order for new tonnage to be received for a long time came from Canada to the firm of Swan Hunter & Wigham Richardson, and was for two steamers of the Great Lake type. One of the vessels will be built at Wallsend and the other at Londonderry.

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Halifax:—The British Steamer "Welshman" rescued the captain and four members of the crew of the Schooner "Stanley Joseph" of St. John's, Newfoundland, according to a message received at Halifax under date of November 27th. The "Stanley Joseph" had been stripped of her sails and rudders in a heavy Northwest gale. The vessel was set on fire before being abandoned but when last seen the fire was apparently dying out and the wreck seemed likely to remain afloat as a menace to navigation. After the rescue had been effected with difficulty the "Welshman" was unable in the heavy seas running to take her life boat aboard again and had to let it go adrift.

* * * *

Halifax:—Owing to trouble with the longshoremen at Portland, Maine, the White Star liner "Megantic" was diverted from that port and ordered to land her mail and passengers at Halifax. The Anchor Liner "Donaldson" was also diverted from Portland to Halifax for the same reason.

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St. John, N. B.:—The last meeting of the council of the Board of Trade for the port of St. John was held at the end of November, and the secretary's report presented. Among other matters mentioned in the report, was the starting of the work on the new livestock sheds, one of these being a public shed to accommodate 600 head of cattle. The C.

P. R. were also providing feeding and watering facilities for cattle in the neighborhood of Megan. Dredging for the new berths on the West Side was about completed, while at the new dry dock dredging was being continued, but the concrete work was suspended for the winter.

* * * *

Newcastle:—There was recently launched from the yards of Swan, Hunter & Wigham Richardson Company, the oil driven cable ship "John W. MacKay." This ship was built for the Commercial Cable Co., and representatives of the War Office and Post Office also of the Admiralty were present at the launching. It is claimed that this ship will be the best equipped cable ship that has been constructed up to the present. She is 360 feet long and has a gross tonnage of 4,100. Another keel for a sister cable ship for this company will be laid down immediately.

* * * *

New Glasgow:—The steamer "Bethlehem" arrived at Pictou early this month, after reporting herself in distress off Shippigan, N. B., as she had lost her rudder. She made port steered by a boom attached to a winch. The "Bethlehem" was carrying 2,700 tons of coal from Sydney to Campbelltown, and is owned by the Atlantic Chartering Co., New York. The C. G. S. "Aranmore" was sent out to aid her into port.

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Vancouver:—Considerable interest has hem" arrived at Pictou early this er "Princess Louise," as she has been constructed almost entirely of materials produced in British Columbia. The builders, The Wallace Shipyards of North Vancouver, placed her on her official trial trip on December 1st. The steamer was required to make a speed of 16 knots in the contract and this demand was more than satisfied in her trial trip. In the morning the steamer passed over the measured course off Parry Bay. A speed of 16.09 knots per hour was reached on this first trip and when placed over the measured mile again the same morning a speed of 16.2 miles was reached. On account of a thick haze settling down over the water which obscured the marks on shore the vessel returned to port. While in port she picked up a number of guests and set out a second time in the afternoon and for three hours cruised in the straits. Her speed averaged from 16.2 to a little over 17. knots per hour. This was considered to be a very good performance and created general satisfaction to all concerned.

* * * *

Vancouver:—A contract for a floating dry dock at Vancouver has been awarded to the Burrard Dry Dock Company of Vancouver. The company is to receive an annual subsidy of four per cent. on $2,500.000.00 for a period of thirty-five years or approximately $112,000.00 per year.

Vancouver:—Trade possibilities between the Canadian Pacific coast and Mexico are being investigated by B. C. Keeley, the general agent of the C. G. M. M. on the Pacific coast. If the investigation proves satisfactory a service will be established between these points. Mr. Young has gone to Mexico to look into the situation from that end of the route.

* * * *

Buffalo:—This port has grain receipts for the season of 1921 which will make the year approach the biggest ever experienced. The actual figures are close to 210,000,000, millions for the season. In 1898 the receipts were 222,000,000, while in 1915 they amounted to 219,000,000, so that 1921 is well able to figure as a fitting companion with these years in the matter of grain received.

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Morrisburg:—The steamer "Pentland," which went aground in the St. Lawrence River near Morrisburg the latter part of November was abandoned to the underwriters early in December. It is stated that owing to the low water the wrecking company was unable to float the freighter, and it was decided to abandon further efforts to salvage her until the spring. It is announced that the "Pentland" is valued at approximately 850,000.

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Detroit:—A. A. Schantz, President of the Detroit and Cleveland Navigation Co., in an address delivered to the Board of Commerce here stated that if the LaFollette Act was not modified there would soon be no lake shipping.

NEW FORM OF STAINLESS STEEL

The early forms of stainless steel were not such as could be easily worked, but a British firm of steel makers has been carrying on a series of experiments with a view to producing a steel which will retain rust resisting properties and can be worked without difficulty both in the hot and in the cold state. These experiments have been successful. The new plastic rustless steel can be stamped, punched, pressed, chased, or engraved cold; and it can be bent cold to a diameter equalling its own thickness without showing any signs of fracture. It may be polished silver bright, and this polish will remain in any atmosphere. In many cases a piece of this steel has less than half the weight of a brass or nickel piece of the same strength.

Arrangements are being made for a large pulp-wood shipping company to have headquarters at Sorel, for transshipping pulp-wood. They will occupy a location up the Richelieu River above the water works, at the city wharf, near a Q. M. & S. Ry. spur.

TRIAL TRIP FROM MIDDLESBROUGH

On Monday, 14th November, 1921, the large steel screw steamer "P.L.M. 23," which Sir Rayiton Dixon & Co., Limited, have built at their Cleveland Dockyard, Middlesbrough, for La Compagnie des Chemins de Fer de Paris a Lyon et a la Mediterranee, whose shipping business is managed by their subsidiary Company, La Societe Nationale d'Affretements, proceeded to sea for her official trials.

The steamer is a single deck vessel of the Harroway-Dixon Cantilever Framed type with top-side water-ballast tanks, her principal dimensions being 400 x 56 x 31 moulded, and she has a deadweight carrying capacity of about 8900 tons on a light draft of water. She has been built under special survey to receive Lloyd's highest classification, also to meet the requirements of French law.

The vessel and her machinery have been constructed under the superintendence of Monsieur Marechal and Captain Veyrat of La Societe Nationale d'Affretements and Mr. Reginald J. Eyres of Messrs. Eyres & Bryers, Newcastle on Tyne, Sunderland and Marseilles.

The trials were highly satisfactory in every way.

PORT OF MONTREAL

During the past summer the congestion at the port of Montreal has been given wide-spread mention and it is of interest to note what the port can do under normal circumstances. Under existing charters each vessel is allowed 5 days to load after being certified by the port warden as being in readiness to receive cargo. These days are known as lay days.

The S. S. Fagaraas arrived in Montreal on Friday evening, November 11, at 6 p.m. and berthed at shed No. 9. Saturday morning she hawled ahead and berthed at shed No. 7. She was fitted out and certified as being ready to receive cargo at 10.30 a.m. on Saturday November 12. She started to run grain at 1 p.m. on Saturday the 12th and worked until 6 p.m. Loading operations were then suspended until 7 a.m. Monday morning and the steamer was fully loaded and ready for sea at 6 p.m. again Monday evening, November 14. This constituted only one lay day. Including all stoppages the vessel was loaded in 9 working hours and took aboard 182,000 bushels of wheat.

We believe that this is a credit to the elevator and to the stevedores of Montreal especially, as no rush provision was made, the work was simply carried out under normal conditions. We believe that if these conditions are fully understood the report of congestion previously circulated will not be so seriously considered and will not be detrimental to the port.

A NEW CABLE STEAMER

The "John W. MacKay," a Telegraph Cable Repairing steamer, which is being constructed by Swan, Hunter & Wigham Richardson Ltd., for the Commercial Cable Co. of New York, was launched from the Neptune Shipyard, Walker, Newcastle-on-Tyne, on Wednesday, the 16th November.

The vessel has been specially designed for her work and is propelled by twin screw steam engines, which together with the boilers, are being constructed by Swan, Hunter & Wingham Richardson Ltd., at their Neptune Works. She is 360 ft. in length by 48 ft. in depth. Her overhanging bow carries 3 cable sheaves, whilst a stern sheave is fitted aft.

The cable will be carried in four cable tanks placed forward of the machinery, which have altogether a coiling capacity of over 50,000 cu. ft. The machinery required for working the cables, including picking up and paying out gears, electric turning over gear, Lucas dynamometers and a Lucas patent sounding machine, are supplied by the Telegraph Construction and Maintenance Co. Ltd., of their latest designs.

The accommidation for the staff on board is specially designed for their comfort in the service in which the vessel will work. On the navigating bridge there is a large glazed shelter to afford ample protection from the weather for those on duty there. The Captain's accommodation will be aranged on the boat deck, there will also be an ample chart room and navigating office. On the shelter deck there will be the staterooms, etc., for the ship's navigating officers, and for the many officers concerned with the cable work. The dining saloon and smoking room for these officers will be below on the upper deck, on which deck are also to be berthed the engineers, petty officers, cable men, seamen, etc.

The propelling machinery made at the Builders Neptune Engine works will consist of twin screw triple expansion engines, supplied with steam by three boilers, working under Howden's system of forced draught, and fitted to burn oil fuel on the Walsend-Howden System.

The vessel will be fitted with the latest patterns of auxiliary machinery for navigating and working, including steam windlass and capstan, steam winches, steam boat hoist, steam steering gears, etc.

The comfort and safety of the officers and crew have been most carefully studied, and the arangements made include ample ventilation, steam heating, electric light, electric bells, telephones, wireless telegraphy and submarine signalling apparatus.

The naming ceremony was witnessed by a goodly gathering and was gracefully performed by Miss Blount, daughter of Mr. E. Blount of the Foreign Office, London. Amongst those present were—Mr. H. F. Russe, Manager in London for the Commercial Cable Co.; Mr. E. Blount of the Foreign Office; Mr. F. J. Brown, C.B.E. of th ePost-Office, and Mrs. Brown; Sir Bertram Cubitt, K.C.B. of the War Office; Commander L Robinson, R.N., O.B.E. of the Admiralty; Mr. F. D. K. Leclercq of the U.S. Embassy; Hon. Evelyn Fitzgerald, C.B.; Mr. C. E. Neilson of the Great Northern Telegraph Co. of Denmark; Mr. C. W. Clark of the Telegraph Construction & Maintenance Co. Ltd.; Mr. E. Ryan of the Eastern Telegraph Co. Ltd.; Capt. R. L. Boyd; Mr. A. B. Sleap; Mr. F. C. Slater, U.S. Consul in Newcastle-on-Tyne and Mrs. Slater, and Mrs. Larnder, wife of Commander F. H. Lardner, O.B.E. of the Commercial Cable Co., under whose supervision the "John W. MacKay" has been designed and built.

A NEAT GAS ENGINE ACCESSORY

It often happens that when the spark apparatus of a gas engine fails the magneto is alleged to be at fault, whereas the trouble is due really to imperfect insulation. A British firm has brought out a simple appliance for testing the insulation without dismantling. This appliance consists of a handle carrying a stem on which an insulated plug and a pivoted lever are united by means of simple connections. The magneto may be tested for spark and the polo-piece for leakage.

ANNOUNCEMENT

In our advertising columns appears particulars of Government construction equipment for sale. This material is under the jurisdiction of the Purchasing Department Commission of Canada, Ottawa, and the location is at Toronto, Bowmanville, Quebec and Rimouski.

We have received from the North Eastern Engineering Co. of Wallsend, On-Tyne, England, a bulletin describing their patent interceptor, for the extraction of oil, water, and other impurities from steam. The interceptor is cylindrical in form, and the interceptor consists of an element made in the form of a trellis, containing holes for the impurities to fall through into the sump.

NOTICE

Mercantile Marine Memorial Plaque and Scroll

(1) His Majesty the King has been graciously pleased to sanction a memorial being presented to the next-of-kin of members of the Mercantile Marine who have lost their lives through enemy action while serving on British ships and to the next-of-kin of British members of the crews of Neutral or Allied vessels under the direct control of the Admiralty or the Ministry of Shipping who have lost their lives though enemy action while serving on such vessels between the 4th August, 1914, and the 11th November, 1918.

(2) The Plaque and Scroll are to be given in respect of:

(a) Those who lost their lives through enemy action whilst serving in any of the capacities referred to above.

(b) Those who died subsequently when their death is proved to be attributable to enemy action.

(3) (i) The recipient is to be the blood next-of-kin of the deceased.

(ii) There is no question of legal succession to the Plaque and Scroll. They will not be issued to any legatee under a will in preference to the next-of-kin.

(iii) The order of the next-of-kin is laid down as follows:

(a) Widow or widower.
(b) Eldest surviving son.
(c) Eldest surviving daughter.
(d) Father.
(e) Mother.
(f) Eldest surviving brother.
(g) Eldest surviving hal-sister.
(h) Eldest surviving half-brother.
(i) Eldest Surviving half-sister.
(j) Paternal grandfather.
(k) Paternal grandmother.
(l) Maternal grandfather.
(m) Maternal grandmother.
(n) Eldest surviving nephew.
(o) Eldest surviving neice.
(p) Eldest surviving uncle on father's side.
(q) Eldest surviving aunt on father's side.
(r) Eldest surviving uncle on mother's side.
(s) Eldest surviving aunt on mother's side.

British War Medals and Mercantile Marine Medals are now ready for distribution. Members of the Mercantile Marine who have already received the Ribbons and the "Authority" authorizing them to wear the same, should apply for the medals to the officer from whom they received the Ribbons, namely, Agent of Marine and Fisheries Department, Office of Examiner of Masters and Mates, or direct to the Marine and Fisheries Department, enclosing the "Authority."

A. JOHNSTON,
24-1 Deputy Minister of Marine and Fisheries.

Medals for Legatees or Next-of-kin

The British War Medal and Mercantile Marine Medal earned by deceased officers, men and women, of the Mercantile Marine are now ready for distribution.

Legatees or next-of-kin should apply for the necessary forms to the agent, Department of Marine and Fisheries, Examiners of Masters and Mates, or direct to the Department of Marine and Fisheries, Ottawa.

A. Johnston.
Deputy Minister of Marine and Fisheries
Department of Marine and Fisheries,
Ottawa, 30th November, 1921. 24-1

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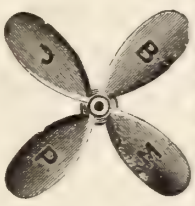

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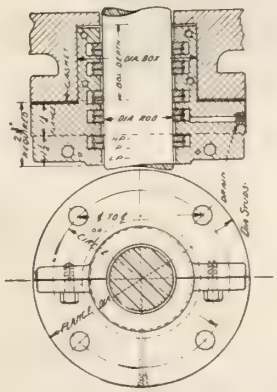

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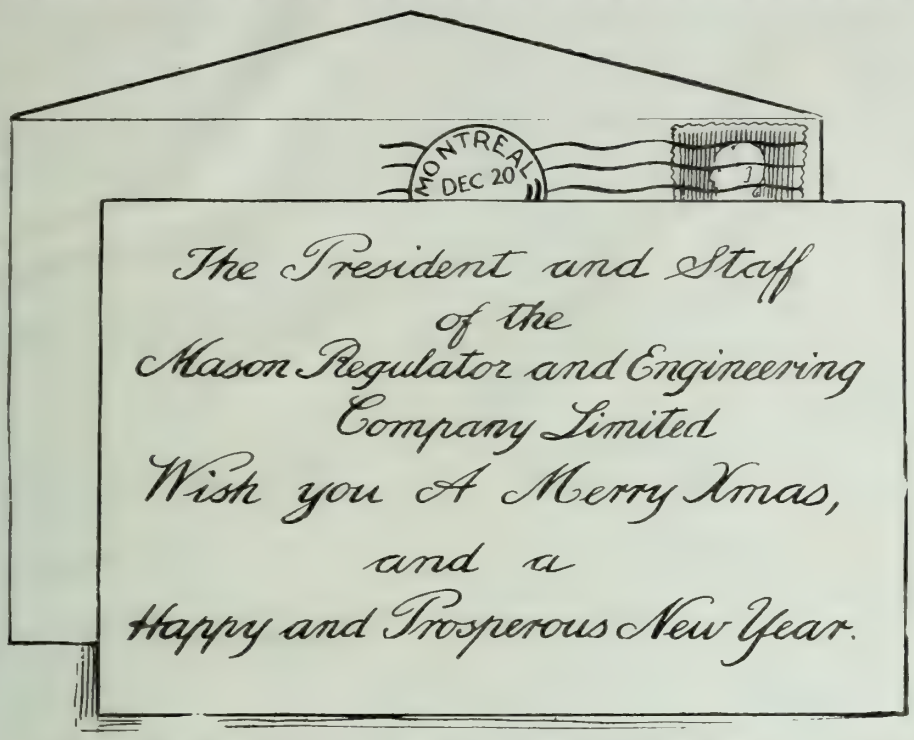

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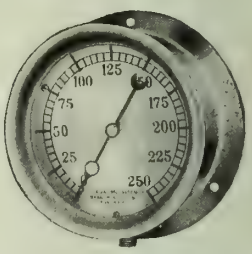

As we pass the three-mile limit and near the coast line of a new year, every thoughtful man feels a spirit of confidence surge over him; for with government questions decided in popular favor and business commencing to boom as of old, surely there is ample room for optimism.

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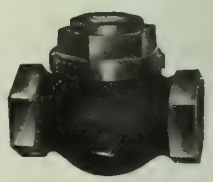

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